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ABSTRACT

This volume is one of four sets of materials produced for training science supervisors in educational technology. It presents principles and practices of educational technology so that science supervisors can develop a working knowledge applicable to their own activities. The "first level" materials contain five units, describing educational technology as a process systematically developed to meet the individual learners needs and shows the need for and the value of the approach in the school environment of today. The script of the audio-tape of each unit is given, and a black and white copy of the slides used with each of the three units which have visuals is provided. "Level two" materials are intended to develop educational decision making and skills. Two units ("Criterion Referenced vs. Norm Referenced testing" and "Diagnostic Testing") were produced by the project; the other five areas covered used commercially available materials which are listed and briefly described in this volume. The "third level" materials consist of a selected list of materials and films describing instructional techniques and teaching aids. Pre- and posttest criterion assessment are appended. (AL)

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EDUCATIONAL TECHNOLOGY PROJECT

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OFFICE OF EDUCATION

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INTRODUCTION TO EDUCATIONAL TECHNOLOGY

SET II

VOLUME THREE

SE 009 863

NATIONAL SCIENCE TEACHERS ASSOCIATION
1201 Sixteenth St., N.W., Washington, D.C. 20036

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Office of Education Bureau of Research

ED044291

F I N A L R E P O R T

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V O L U M E T H R E E

INTRODUCTION TO EDUCATIONAL TECHNOLOGY (SET II)

Educational Technology Project
National Science Teachers Association
Washington, D.C. 20036

February 1970

U.S. DEPARTMENT OF
HEALTH, EDUCATION, & WELFARE
OFFICE OF EDUCATION
BUREAU OF RESEARCH

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P R E F A C E

Set II presents the principles and practices of educational technology so that the science supervisor can develop a working knowledge applicable in his own educational supervisory activities on a local level. This program is not designed to train accomplished educational technologists but rather to provide a level of conceptual understanding which will enable a supervisor to utilize this process to meet his professional responsibilities. / 1

Materials have been developed on three levels of activity:

Level one: Introduction and exposure

Level two: Basic skill development

Level three: Bibliographic sources for advanced development

The major learning goals of Set II are that the supervisor will:

a) Establish an understanding of educational technology and its approach as well as some of the more common educational technology terms.

b) Develop a positive attitude toward the process of educational technology, identifying areas for utilization in science education and the science supervisor's activities. The presentations will provide specific reasons for and applications of educational technology.

All of the material is oriented toward specific examples of utilization as contrasted with a strictly theoretical approach. There is emphasis on interaction between the supervisor and what is being presented. / 2

Specific terminal objectives for a supervisor who proceeds through the set are, first, in the cognitive and affective domain; second, related to basic skill and discrimination development in specific areas of the educational technology process.

O B J E C T I V E S

Level One Objectives

Affective (for the entire set)

To have the supervisor self direct his own learning by selecting level two and level three in-depth programs.

Cognitive

a) To have the supervisor describe and cite examples of the interrelationship of science, art, and technology.

b) To have the supervisor describe and construct hypothetical examples of, the relationship between learner characteristics and the application of educational technology.

c) To have the supervisor discriminate between and cite examples of learner-centered and nonlearner-centered priorities in education.

d) To have the supervisor cite examples of change forces in American life to which American education has not responded.

e) To have the supervisor identify the requisite skills of a production team and describe the function of those skills in the development of a learning system.

Level Two Objectives (These objectives refer to skills developed by particular packages within the set and will not necessarily all be reached unless the supervisor utilizes all of the level two material.)

Cognitive

a) To have the supervisor distinguish between criterion referenced and norm referenced tests, both in terms of content and in implementation. / 4

b) To have the supervisor identify and discriminate the necessary elements in a diagnostic test.

c) To have the supervisor specify specific information items necessary for entry level information, given a sample learning strategy.

*d) To have the supervisor prepare simple objectives for areas of a science program.

*e) To have the supervisor outline a simple production system design.

*f) To have the supervisor identify potential media sources for development of a given learning strategy.

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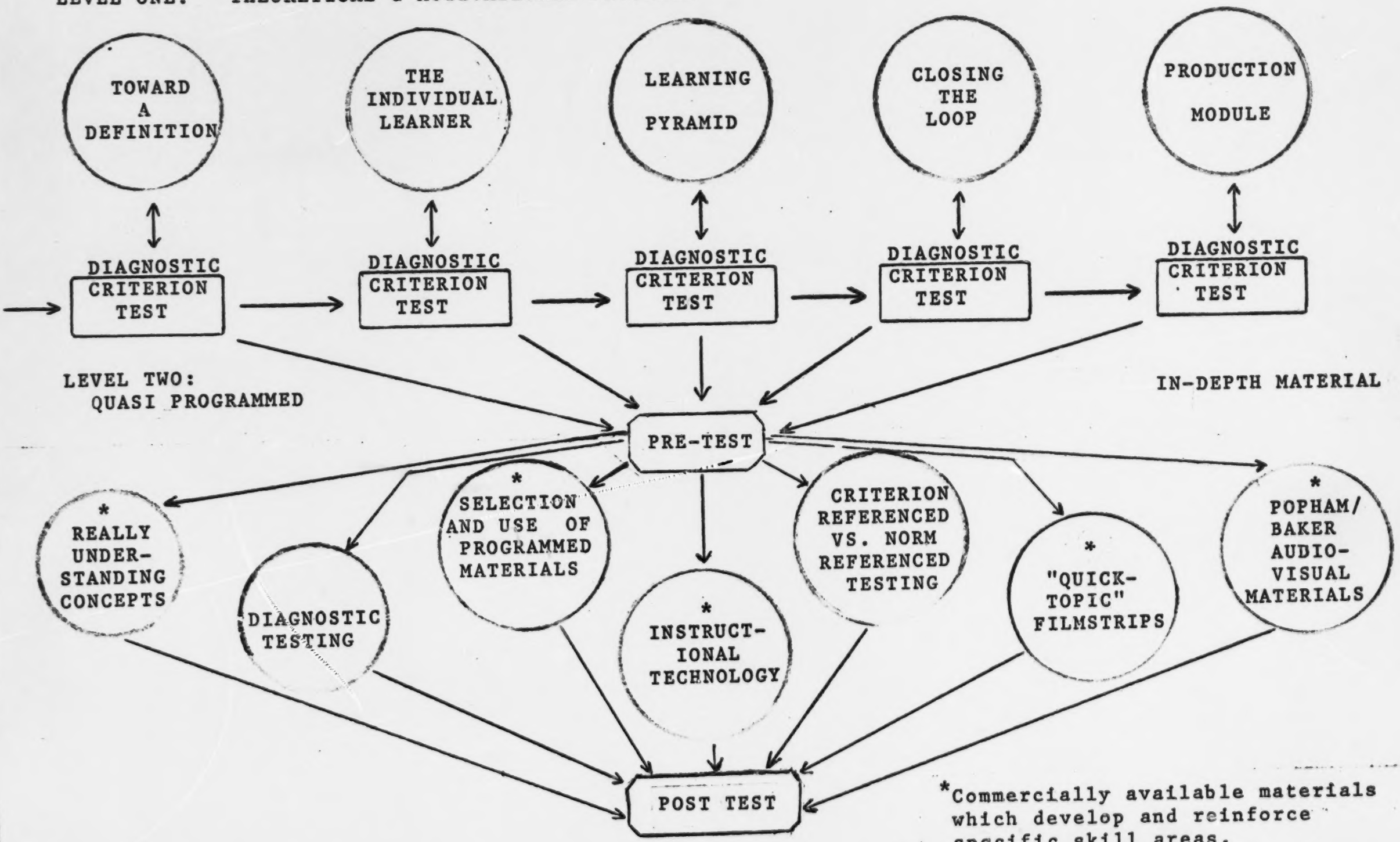
*These objectives are met by commercially available material, included in Set II, but not produced by the project staff.

LEVEL ONE: THEORETICAL & MOTIVATIONAL PROGRAMS



*Commercially available materials which develop and reinforce specific skill areas.

LEVEL THREE: ADDITIONAL RESOURCES FOR LEVELS ONE AND TWO

Learning Design

A) Set II is designed as a self-contained instructional unit. The participant begins with an entry level test* designed to insure that he has the prerequisite learning necessary for participation and interaction with the mediated materials. If he does not have the prerequisite knowledge or skill, he will be given material that will enable him to attain the initial entry level characteristics. Another part of the entry level test* is designed to measure the participant's attitudes about some of the content of the program. Attitudes can precondition a person's reaction to the program in either a positive or negative manner. Attitude assessment will provide some indication of the type of reaction. It will also provide a criterion by which the participant can assess changes in his attitudes after completing the learning program.

B) After the entrance activity, the participant begins the instructional sequence with the first package on level one (Toward a Definition). Included with this package is a pre-test to determine the extent to which the participant already has the desired learning outcomes of the package.

---

* Specific entry level tests and definitive instruction strategies, based on test results, have not yet been developed. These items can only be prepared in outline form until after validation activity has been completed on the learning sequence and criterion tests.

If he is competent in a given area, rather than taking the specific package, he may select either in-depth material from level two or continue to the next package (and its pre-test) in level one. If the pre-test shows weakness in the content areas presented in the package, the participant will go through the learning material and complete the post-test to assess the value of the package. At this point, he may continue to the next package (and its pre-test) or select from level two in-depth material.

/ 7

Each package contains a pre-test in order to allow the participant to determine whether or not he needs to go through the learning material, a post-test to assess the material's effectiveness. He is free, at any time before, during, or after a level one package, to go to any of the level two materials. Level one packages, however, are designed to be taken in sequential order. This means that on level one the participant should only begin a package after indicating, either by pre-test or going through the learning sequence of the previous package, that he has acquired the learning content of the previous package.

Level three may be used at any time, and in any way the individual desires. It is a detailed extention and reinforcement of specific areas presented in both level

one and level two.

The choice of whether to and/or when to utilize level two and three material is at the discretion of the individual participant and will depend upon his motivation and needs as a result of the level one activity.

CONTENT AND LEARNING DESIGN

This set is designed on three levels of increasing detail of material (see the chart on page three). The basic material of level one presents educational technology as a process (Definition of Educational Technology), systematically developed (Production) to meet the individual learner's needs (The Individual Learner) and shows the need for and value of this approach (Learning Pyramid) in the school environment of today (Closing the Loop). These materials are all in either audio tape/slide or straight audio tape format. Included with each of these mediated packages* is a criterion test for assessing effectiveness of the package and for providing direction toward other material. This first level is not intended to do any more than provide basic information about educational technology and its applications, and provide motivation to seek further detail and skill development through levels two and three.

Level two is directed toward the development of basic educational technology decision-making and skills. Not that the learner will be an accomplished educational technologist after completing the set, but rather that he will know, for

---

*NOTE: For this report, only the scripts for the media packages are included.

example, what makes a good behavioral objective and how to distinguish between a good and a poor objective. The areas covered in level two include:

1) Criterion Referenced vs. Norm Referenced Testing
2) Diagnostic Testing
3) Popham/Baker materials
4) Principles and Practice of Instructional Technology
5) "Quick-Topic" Filmstrips
6) Really Understanding Concepts
7) Selection and Use of Programmed Materials

Packages three through seven are commercially produced.

The first two packages were produced by the project and are in an audio tape format with a criterion test for assessment of the learning sequence. The remainder of the materials are all in some media format and in most cases contain criterion tests.

Level three is a further extention of level two. Although all of the material is only in bibliographic format, it provides extensive in-depth references for extending and refining the basic skills developed in level two as well as considerable application information referenced to the needs of science education.

LEVEL ONE: SPECIFIC PROCEDURAL ACTIVITY

A) Within this level you should proceed at your own pace, judging by the results of the pre-test whether or not it is necessary to go through a learning sequence. You may still go through a sequence, if you wish, even though your pre-test indicates that you already have the knowledge. / 11 The five packages on level one are sequentially arranged so that each succeeding package builds, to some degree, upon the content of earlier packages.

B) You may at any time go to a specific area in level two or read any of the material listed in level three that will meet your learning needs or interests.

C) Before proceeding to the first package on level one (Toward a Definition), it might be advisable to read the package descriptions on levels one and two, and at least skim the bibliographic references on level three. This initial exposure will make it easier to find specific material when the need arises.

D) After reviewing the material available in this set, go on to the first package (Toward a Definition) and complete the pre-test. Remember these tests (or assessments) provide you with the data necessary to decide whether or not to go through the learning sequence.

E) If the pre-assessment results indicate a need to go through the learning sequence (or if you want to go through it in any case), read the hardware requirements listed on the description page.

F) Set up the hardware, and go through the learning sequence. Proceed at your own pace. Stop and go back, or just stop at any point you wish in the sequence. There is no time limit.

G) After completing the learning sequence, complete the post-assessment. This test will indicate how successful the learning sequence was in communicating its content. By comparing your post-assessment and pre-assessment responses, you will be able to evaluate the changes in your learning behavior which have resulted from the presentation.

H) You may now go on to the next package (The Individual Learner), and repeat steps D through G. Remember, at any point you may stop and utilize levels two and three.

I) Continue on through the remaining packages in order --

Learning Pyramid

Closing the Loop

Production --

repeating steps D through G.

J) When you have completed all of the level one packages you may proceed to the next set: An Application of Educational Technology.

The following package titled Toward
a Definition was prepared by

Writer: Layton Mabrey

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Criterion Assessments: George H. Ziener

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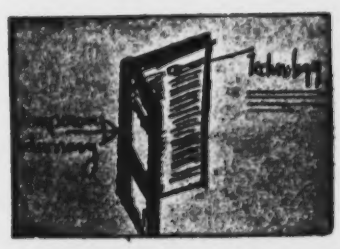
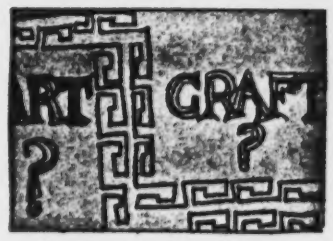
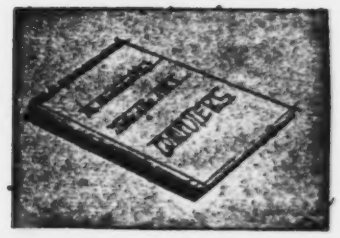
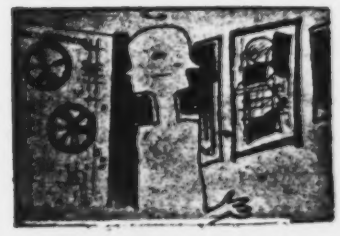
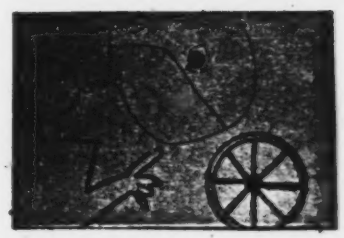
TOWARD A DEFINITION

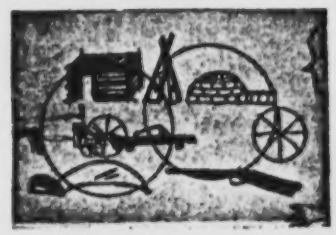
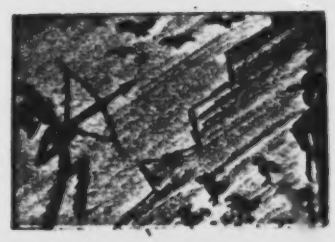
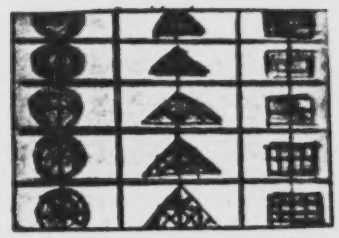
The relationship of science, art, and technology is developed etymologically, historically, and analytically. Characteristics of technology as applied to learning are briefly traced and some aspects of educational technology are presented. The participant is allowed to construct his own definition, given certain critical concepts.

The package consists of audio tape, slides, and an interaction type of pre-post assessment.

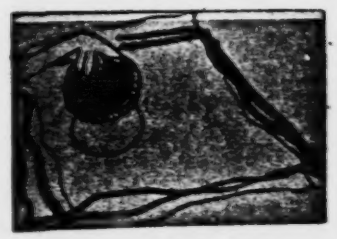
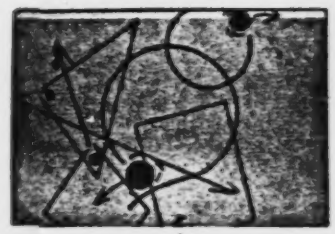
Toward A Definition

SOUND	VISUALS
1. Technology as a word, is treacherous to define....not as scientific as it would seem....It came from Greece and from the words "techne" meaning "art" or "craft" and from "logos" meaning "a study of"....	
2. ....A contemporary dictionary definition is "the science or study of the practical or industrial arts." When we mix the word art into today's definitions the picture begins to blur....How is art used?	
3. Industrial arts suggest Crafts and the Greek definition splits into Art or Craft. What is art? What is craft?	

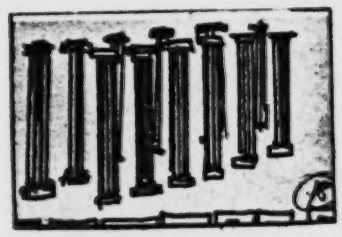
SOUND	VISUALS
4. ....Again, today, we frequently come across "State of the Art" reports on predominately <u>technical subject</u> matter.	
5. These several uses of the word <u>Art</u> and the word <u>Craft</u> have become dependent on the user's point of view....and neither the Dictionary or the Classic definition appears to apply as a pure definition any longer.	 / 1
6. Another point of view on the definition of technology comes from the social scientist.... "In regard to societies already industrialized or becoming so -- the term denotes the whole or an organized sector of, the body of knowledge about scientific principles and discoveries and....	

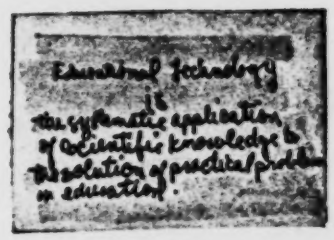
SOUND	VISUALS
7. ....existing and previous industrial process, resources of power and materials, and methods of transmission and communication which are thought to be relevant to the production or improvement of goods and services.	 / 18
8. Charles Singer, in his <u>History of Technology</u>, defines technology quite briefly as...."How things are commonly done (AND) what things are done or made....".	
9. Technology to John Kenneth Galbraith means...."the systematic application of scientific or other organized knowledge to practical tasks....	
10. ...."Its most important consequence is in forcing the division and sub-	

SOUND	VISUALS
10. Continued. division of any such task into its component parts. Thus and only thus, can organized knowledge be brought to bear on performance...." (The New Industrial State, Galbraith)	/19
11. At this point, it might be good to stop and take stock of the concepts presented in a definition of technology. Go to question one on your post-test. There are a number of terms; indicate your understanding of how they fit into a definition of technology based on the presentation to this point.	BLACK SLIDE
12. Edward Hall, the anthropoligist, it would seem, answers Galbraith....	

SOUND	VISUALS
13. ...."As a rule Americans think of time as a road or ribbon stretching into the future along which one progresses. The road has segments or compartments which are to be kept discrete (one thing at a time). People who cannot schedule time are looked upon as impractical."	/ 2
14. ....Again Hall comments on Americans' use of space...."Our concept of space makes use of the edge of things. If there aren't any edges, we make them by creating artificial lines." (Edward Hall, The Silent Language)	
15. Hall's comments stand as warnings to the technologically-bent mind.... Especially the American....perhaps we are dealing with events in space and time which have stagnated with artifically created boundries and which should be reviewed and released in new directions.	

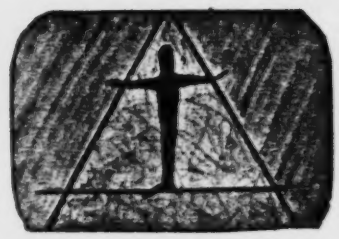
SOUND	VISUALS
16. These ideas warn us of absolutism of approach and artificial rigidity. Do you wish to alter your opinion of the terms in question two on the post-test?	BLACK SLIDE

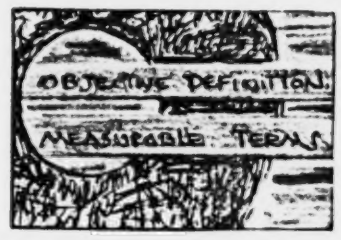
17. Back to the Greeks....Another very early meaning of the word technology suggested "an ordering of subject matter in an orderly fashion so that it could be taught."	
18. Socrates added to this by formulating a scientific method: hypothesis, step by step analysis, and conclusion, either proving or disproving the hypothesis....	
19. Centuries later, the Italian, Montessori introduced an <u>imaginative</u> and <u>structured</u> learning	

SOUND	VISUALS
19. Continued. experience, employing an <u>analysis</u> of performance objectives, <u>sub-division of</u> tasks, a self-pacing technique for the individual learner.	/ 22
20. She, in effect experimented with a primitive form of behavioral technology by developing a "discovery-prone" environment. Her work served as a fountainhead for a number of today's educational efforts applying technology.	
21. Therefore, we might suggest that <u>Educational Technology is the systematic application of scientific knowledge to the solution of practical problems in education</u>....	 Educational Technology is the systematic application of scientific knowledge to the solution of practical problems in education.

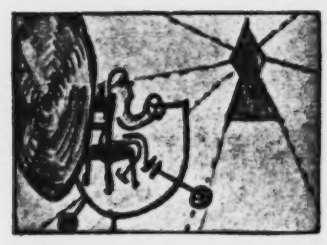
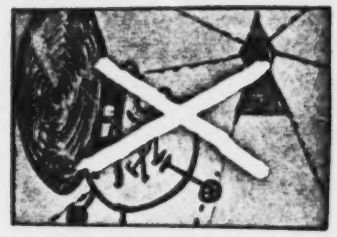
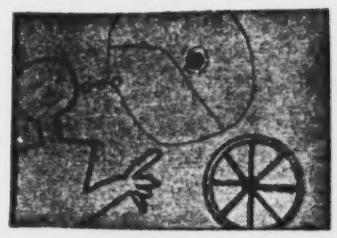
SOUND	VISUALS
22. Again some of us may see it as a a kind of educational systems engineering process....the primary objective; the improvement of educational practice to produce more efficient learning....	

/ 23

23. We have now added the word education to technology, used an example of an early approach, and suggested two possible definitions. Go to question three and indicate whether there are any changes now that we are defining <u>educational</u> technology rather than technology.	BLACK SLIDE
24. Educational technology, summarized as a learner-oriented systems approach, has certain characteristics vital to a full definition.	

SOUND	VISUALS
25. Some of the necessary concepts include a specific measurable terminal point, objectives.	
26. Before a system can be developed to reach the terminal points, there needs to be a realistic assessment or understanding of the learner and the resources that can be made available to him.	
27. Once the objectives and learner characteristics are identified, the available resources can be structured and utilized to enable the learner to reach the objectives.	

/ 2

SOUND	VISUALS
28. The whole process must be empirically validated and revised as necessary to produce optimum learning, it must be flexible.	
29. In the application of this process we call educational technology, machines may or may not be used. They are only tools of the technology process, not the process itself.	
30. In summary, technology, as a term is both by definition and in use, not machine or product. It is process.	
31. Educational technology is also process not machine.	

SOUND	VISUALS
32. What is the full, fixed, rigid definition of educational technology? There is no one inflexible definition.	
33. Go to question four and develop your own definition.	BLACK SLIDE

/ 2

EDUCATIONAL TECHNOLOGY PROJECT

27

PRE-

criterion assessments

TOWARD A DEFINITION

For this report the desired responses have been included on the sheet opposite each question.

NATIONAL SCIENCE TEACHERS ASSOCIATION
1201 Sixteenth St., N.W., Washington, D.C. 20036

CRITERION ASSESSMENT-PRE

SET II PACKAGE TOWARD A DEFINITION

DATE _____ NAME _____

STIMULUS							RESPONSE
1. Technology is:							An answer in the middle indicates a balance, no answer indicates no opinion.
		Favorable	Mildly Favorable	Balanced	Mildly Favorable	Favorable	
Art	2	1	0	1	2	Science	
Practical	2	1	0	1	2	Theoretical	
Continuous	2	1	0	1	2	Terminal	
Rigid	2	1	0	1	2	Flexible	
Complete	2	1	0	1	2	Growing	
Product	2	1	0	1	2	Process	
Systematic	2	1	0	1	2	Random	

/ 28

CRITERION ASSESSMENT-PRE

SET II PACKAGE TOWARD A DEFINITION

DATE _____ NAME _____

STIMULUS							RESPONSE
2. Educational Technology is	Favorable	Mildly Favorable	Balanced	Mildly Favorable	Favorable		/ 29
Art	2	1	0	1	2	Science	
Practical	2	1	0	1	2	Theoretical	
Continuous	2	1	0	1	2	Terminal	
Rigid	2	1	0	1	2	Flexible	
Complete	2	1	0	1	2	Growing	
Product	2	1	0	1	2	Process	
Systematic	2	1	0	1	2	Random	
Machine	2	1	0	1	2	Method	
Learner (Oriented Toward)	2	1	0	1	2	Teacher	
Subjective	2	1	0	1	2	Objective (In Approach)	

3. Write your definition of Educational Technology

EDUCATIONAL TECHNOLOGY PROJECT

30

POST-

criterion assessments

TOWARD A DEFINITION

NATIONAL SCIENCE TEACHERS ASSOCIATION
1201 Sixteenth St., N.W., Washington, D.C. 20036

CRITERION ASSESSMENT-POST

SET II PACKAGE TOWARD A DEFINITION

DATE _____ NAME _____

STIMULUS	RESPONSE
1. In terms of the presentation to this point, how would you define technology? The terms presented are contrasts. By definition technology is: Art 2 1 0 1 2 Science Practical 2 1 0 1 2 Theoretical Continuous 2 1 0 1 2 Terminal Rigid 2 1 0 1 2 Flexible Complete 2 1 0 1 2 Growing Product 2 1 0 1 2 Process Systematic 2 1 0 1 2 Random	An answer in the middle indicates a balance, no answer indicates no opinion. / 31
2. If your definition to technology has changed in the areas shown below indicate your new value. No Change Rigid Flexible _____ Product Process _____ Systematic Random _____	

CRITERION ASSESSMENT-POST

SET II PACKAGE TOWARD A DEFINITION

DATE _____ NAME _____

STIMULUS	RESPONSE
3. By definition educational technology is:	/ 32

Art	2	1	0	1	2	Science
Practical	2	1	0	1	2	Theoretical
Continuous	2	1	0	1	2	Terminal
Rigid	2	1	0	1	2	Flexible
Complete	2	1	0	1	2	Growing
Product	2	1	0	1	2	Process
Systematic	2	1	0	1	2	Random
Machine	2	1	0	1	2	Method
Learner (Oriented Toward)	2	1	0	1	2	Teacher
Subjective	2	1	0	1	2	Objective (In approach)

4. In summary, all of the terms above have some place in a definition of educational technology. Using as many or as few as you wish, construct your definition of educational technology as you now understand it.

The following package titled The Individual Learner was prepared by

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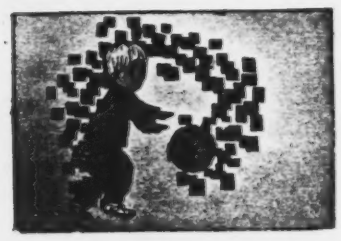
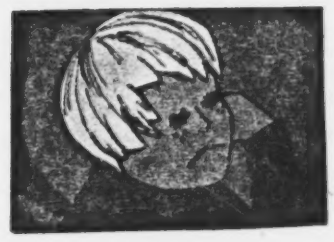
THE INDIVIDUAL LEARNER

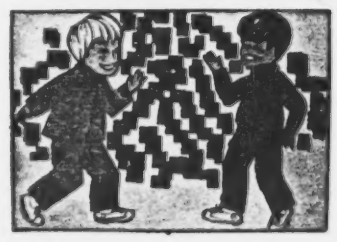
Two learners--individuals with varied backgrounds, attitudes and knowledges--are used to show how educational technology can provide for their needs by alleviating the problems encountered in the traditional classroom. Reasons for a systems approach and one such system are developed. / 34

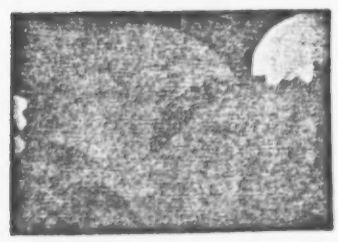
This audio tape and slide package includes a pre-post assessment.

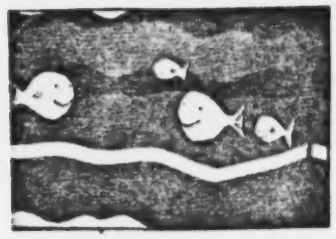
SOUND	VISUALS
1. ....and so a boy, one day fell willynilly into a deep and green and wonderful forest....and his name was Thomas....	
2. ....and for a time Thomas was very happy in his new setting....	
3. ....but before long he became very lonely....	
4. ....he attempted to find new things to do....or even new ways to do old things....and yet somehow nothing seemed to happen....	

SOUND	VISUALS
5. ....he needed someone else besides himself and a ball that couldn't talk or laugh or shout....he needed someone to play with.... to learn with....	

/ 36

6. ....so Thomas started across the green forest and it was not long before he found another lad in another part of the forest....	
7. ....and this other lad was Joseph....	
8. ....the boys became friends and for many days they played and talked and found out new things together....	

SOUND	VISUALS
9. ....And then one day it happened.... Down by the sea, the two boys looked out at the water ....Isn't it a fine blue sea? remarked Thomas....	
10. ....No, it's a vicious red sea, replied Joseph....	
11. ....The sea is friendly and fun....	
12. ....The sea is an enemy....	
13. ....Friendly....	
14. ....Vicious....	

SOUND	VISUALS
15. ....FRIEND....	
16. ....ENEMY....	
17. (Slide change only)	
18. (Slide change only)	
19. ....The boys argued and fought and went their separate ways....	

SOUND

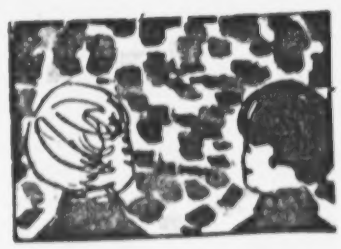
VISUALS

20. ....They were seeing the sea but each in his different way.... Thomas remembered it as he sailed along with his father, and tore up the sandy beach and into the breakers and made sand castles....

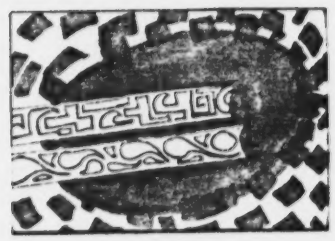
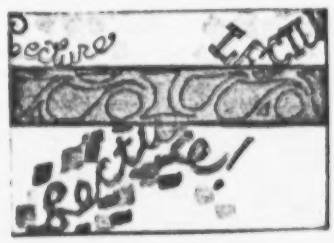
/ 39

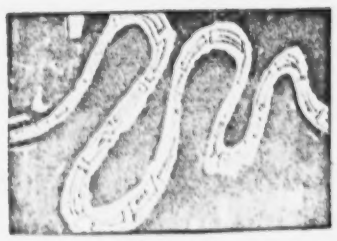
21. ....Joseph remembered it as an unhappy experience where he was tossed into the sky, rolled in and out and round-about....bumped hard on the sandy beach....

22. Educational technology....proposes to help Thomas and Joseph see the sea a bit nearer to the way it actually is....



23. ....It may serve as a means of separating the explicit from the non-explicit factors in education....and perhaps help us

SOUND	VISUALS
23. Continued. to deal with the non-explicit, the artistic, the educational intangibles....	
24. Now Thomas is the BLUE LINE and Joseph, the RED LINE. They both start out together, equals in one sense - yet unequal in another....Each from a diverse environment....	
25. ....In a traditional educational pattern, a lot of things happen. Forces begin to invade the learning experiences of the boys.... their different environments result in their seeing things in different ways.	
26. Lectures, though they may be good, just do not get through....	

SOUND	VISUALS
27. ....Curriculum is not meaningful to the student....there are a lot of unanswered questions....	
28. ....Plenty of teaching facilities, but they're not integrated in the teaching program but rather tacked on....	
29. ....Too many other students create an overcrowded environment....	
30. ....not enough teachers to do the job, even a mediocre one....	
31. ....other pressures from families, peer groups, tradition and sexual awareness....	

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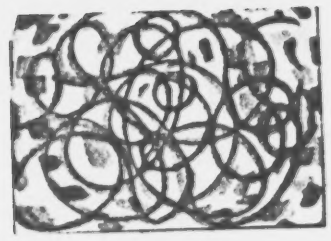
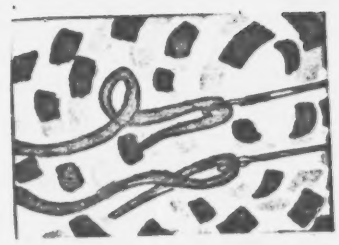
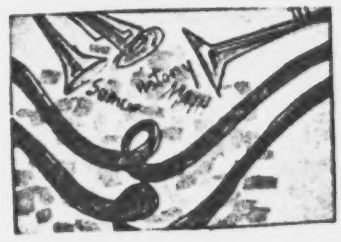
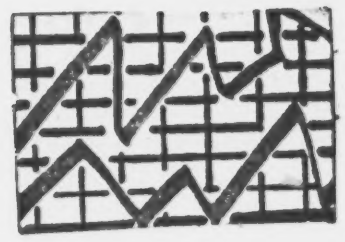
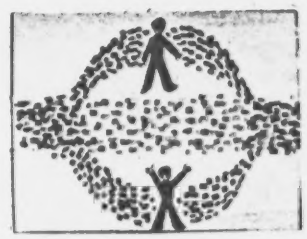
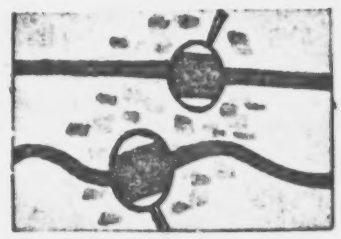
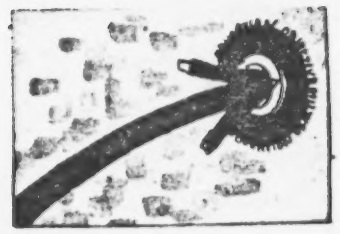
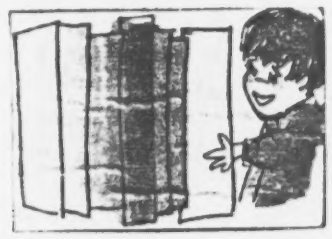
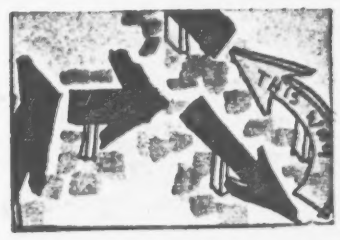
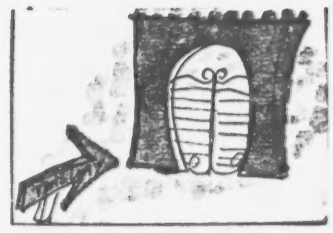
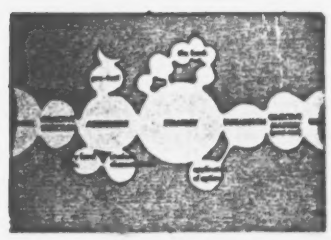
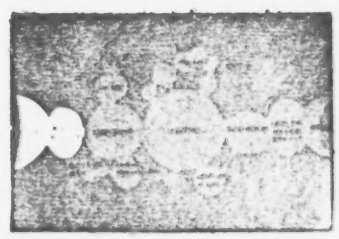
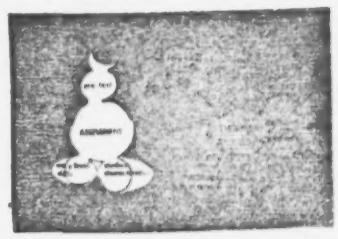
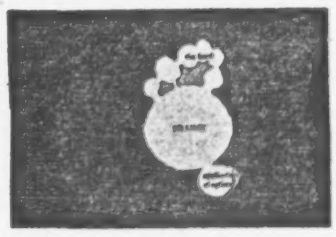
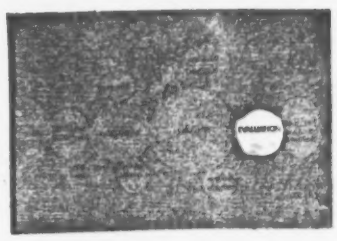
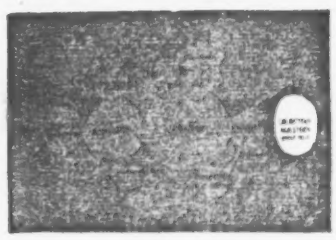
SOUND	VISUALS
32. ....the drug limbo/reality....	
33. ....and these pressures tend to dislocate and distort the learning of Thomas and Joseph, into a jumble of squiggly, frustrated experiences, 'til if carried far enough, NOUGHT NOWHERE IS NEVER REACHED'....	 / 42
34. To apply EDUCATIONAL TECHNOLOGY FULLY to the cause....to help the boys maintain a straight course through the learning process the teacher must assume a new role....	
35. ....She now becomes a manager rather than....	

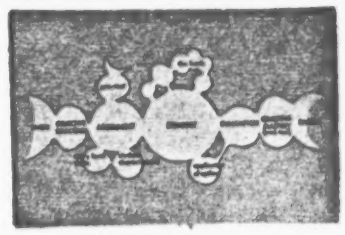
SOUND	VISUALS
36. ....a <u>performer</u> in an <u>information dispensing</u> role, whereby she doles out information, runs a battery of norm-referenced tests....	
37. ....<u>she compares the boys to each other rather than to themselves</u> and sends them on their way.... <u>BUT really not knowing whether, what, or how they have learned....</u>	
38. In getting things done, utilizing a systematic approach we must always keep in mind we're working through an ON-GOING PROCESS AND THAT THOMAS AND JOSEPH REALLY ARE THE IMPORTANT PRODUCTS OF THE PROCESS....	
39. ....Our challenge as committed educational technologists is to RECOGNIZE THOMAS AND JOSEPH AND ALL THE OTHERS AS INDIVIDUALS....	

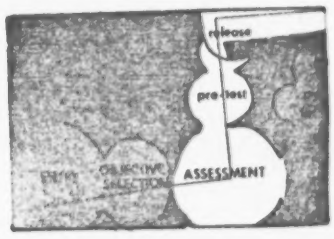
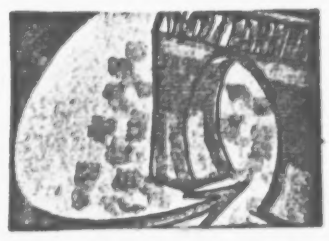
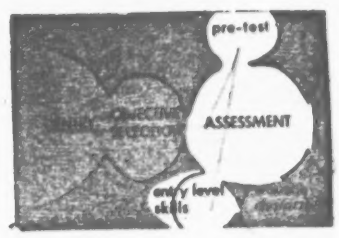
SOUND	VISUALS
40. Some students, perhaps, already know a great deal of what we want to teach them....	
41. Other students, do not have the basic competencies which will enable them to get off the ground....	/ 44
42. ....And so the educational technology approach in the beginning determines if the learner knows the basic composition of the sea....	
43. ....The educational technology approach determines IF Tom and Joseph DO or DO NOT have an edge on learning about the sea, its chemical and physical makeup.... Does the student need reinforcement activities to bring him up to ENTRY status?	

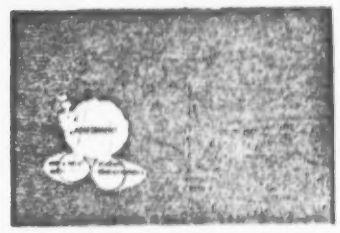
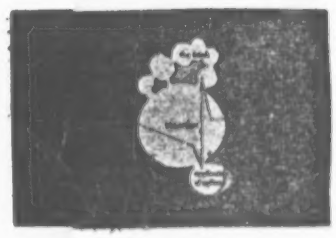
SOUND	VISUALS
44. ....Discrimination talents are carefully tested. Does the student possess the ability to draw firm distinctions between the blues, the reds, the yellows, the yellow reds?....Can he sequence in a meaningful way, the chemical and physical components of the sea?....	 / 45
45. Educational technology recognizes the <u>individual's deficiencies and competencies then attempts to pinpoint the most favorable time for entry into the learning experience</u>....	
46. ....Again educational technology provides the <u>learners with the best learning strategies available at the time</u>....	

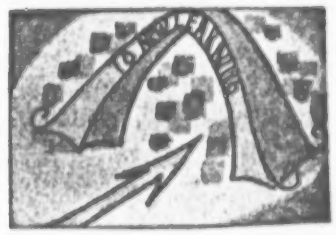
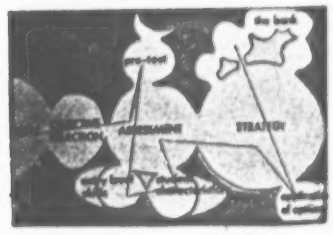
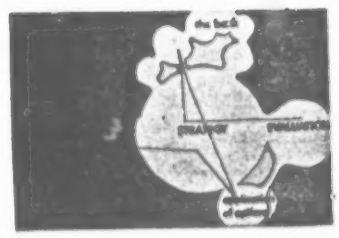
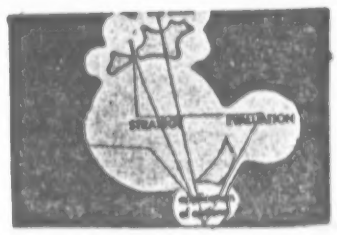
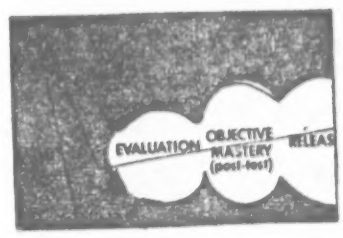
SOUND	VISUALS
47. ....educational technology systematically evaluates students' progress, redirecting them if necessary....	
48. AND RELEASES THEM FROM THE PROCESS, READY TO MOVE ON....	
49. ....Releases them as USEFUL TO SOCIETY PRODUCTS, ready to add their contribution to that society.	
50. A model of a student learning system might look like this....	
51. ....Entry point and <u>objective selection</u>....	

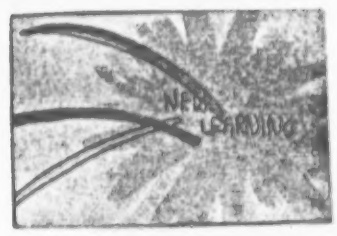
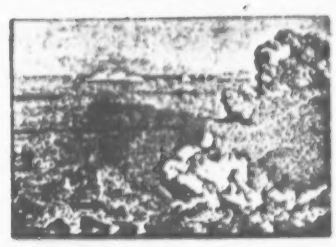
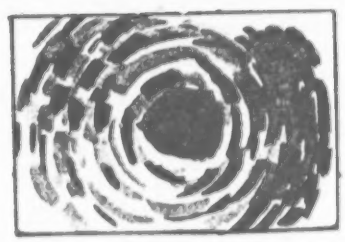
SOUND	VISUALS
52. ....Assessment, a sub-process including the elements of pre-test, entry level skills, and student characteristics....	
53. ....Strategy, a sub-process, enlisting a bank of options which, when carefully applied, result in an individually prescribed course of learning activities, as well as the effective sequencing and timing of those activities.	
54. Evaluation, a sub-process, assessing the student progress and redirecting the student to new learning options until finally....	
55. ....he attains mastery of the objectives prescribed at the start of this learning experience.	

SOUND	VISUALS
56. The student is now released to continue the process of learning for other objectives.	
57. Let's return to our students Thomas and Joseph and for extra interest, introduce Cindy as a springtime yellow.	/ 48
58. Cindy represents a third environment, perhaps a relatively neutral midwest setting. She has never seen the sea....	
59. ....Each of our students represents an individual learner with certain knowledge, skills, and background.	
60. They enter the system as individuals. The objectives are selected,	

SOUND	VISUALS
61. ....and Thomas, our blueboy, enters the assessment phase. The pre-test shows that he already has mastery of the objectives.	
62. As a result, he is released from the system to begin a new learning experience.	
63. Cindy yellow enters the system and the pre-test indicates that she does not have mastery of the objectives.	
64. It is now vital to determine whether or not she has the back-ground learning required to reach the objectives.	

SOUND	VISUALS
65. She can -- and does continue in the system. If she needed entry level information she would have been released to another learning system designed to enable her to reach entry level. Before Cindy actually begins a particular learning strategy we must assess her learning characteristics to determine....	
66. ....just what learning options will meet her particular needs. Cindy then utilizes materials from the bank.	
67. Her progress is evaluated and she proceeds to the post test and has reached mastery of the objectives.	

SOUND	VISUALS
68. Now Cindy is released too, from the system, to enter into new learning experiences.	
69. Joseph, like our other two students, enters the system, is assessed, and begins utilizing prescribed materials from the bank.	
70. However, evaluation shows that the materials have not provided sufficient learning development....	
71. ....and he goes back to the bank for other options that will provide for his needs at this point.	
72. This time Joseph proceeds to the post test. He has reached objective mastery.	

SOUND	VISUALS
73. Joseph joins Cindy and Thomas in new learning experiences.	
74. Because they are individuals, they may never all see the sea in quite the same way....	
75. ....But their learning has brought them together and still allows them to be individuals. Oh by the way, what was the sea really like?	
76. By the end of the learning experience, all three students had proven to themselves through chemistry....a biologican "sea game", Gordon Cooper's Gemini shots, and a programmed field trip....	

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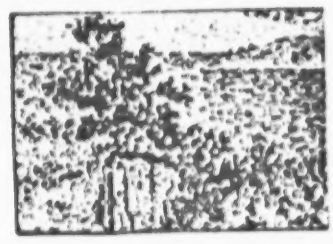
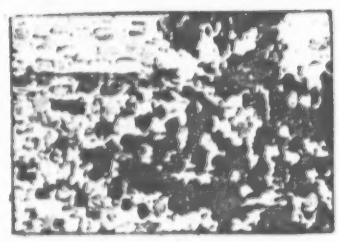
	SOUND	VISUALS
77.	....that Thomas was wrong about the color, Joseph about the terrible fish, and that Cindy, who through a systematic laboratory analysis, and who had never seen the sea, was closest of all. The sea was a vast system within itself.	
78.	Not red....not blue....but a pointillage of color.	

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EDUCATIONAL TECHNOLOGY PROJECT

PRE-

criterion assessments

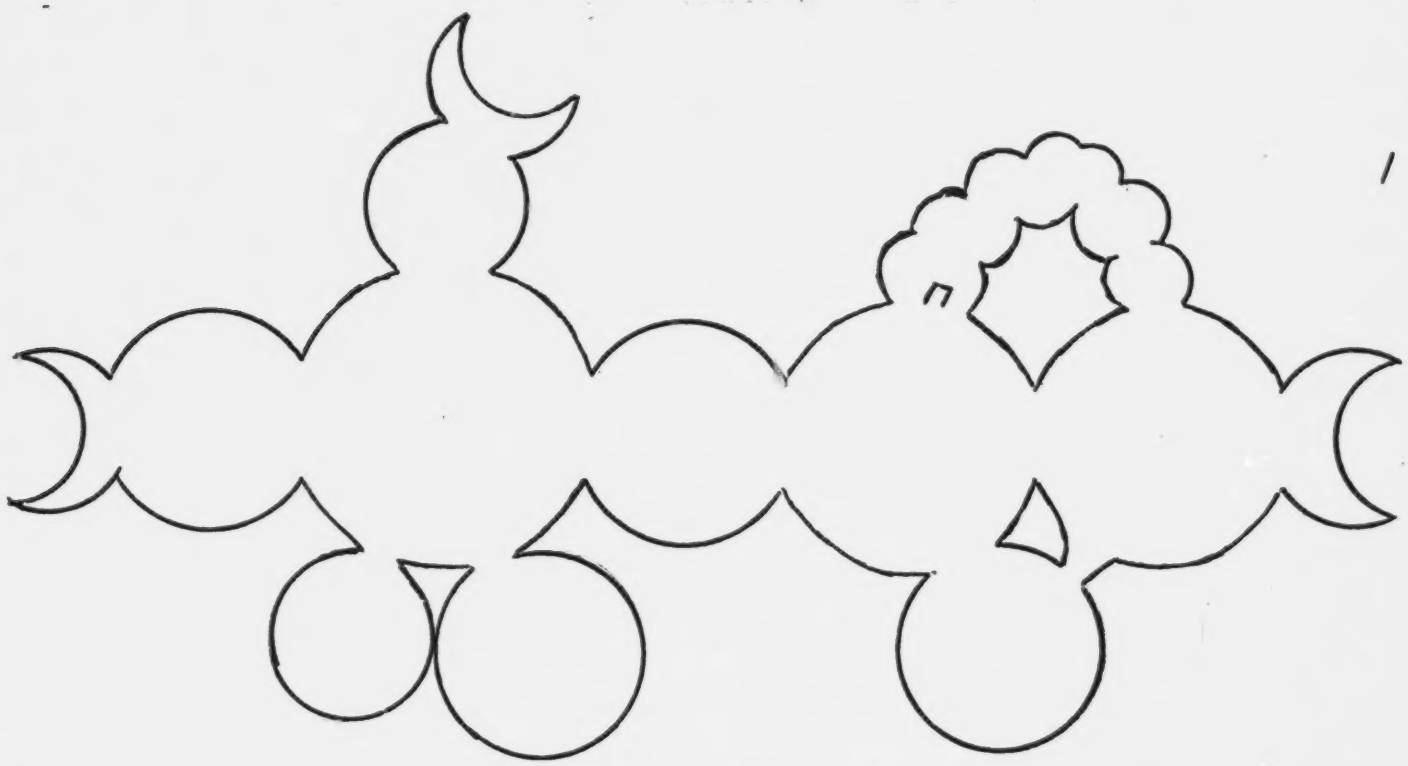
THE INDIVIDUAL LEARNER

NATIONAL SCIENCE TEACHERS ASSOCIATION
1201 Sixteenth St., N.W., Washington, D.C. 20036

PRE-TEST

THE INDIVIDUAL LEARNER

1. Given the picture of a learning system, and the names of its parts label each part of the learning system correctly.



/ 55

Assessment

Strategy

Pre-Test

Evaluation

Objective Selection

Bank of Options

Entry Level Skills

Objective Mastery (Post-Test)

Release

Student Characteristics

Application of Options

Release

2. Each part of a learning system has a specific function. Match the name of the part to the description of its function. (Use the names given in Question 1.)

A. Multiple learning activity packages, including media. _____

B. Comprises three analyses which describe target student population. _____

C. Student exit from learning system with stated percentage competency required. _____ / 56

D. Statement of behaviors to be learned by the student. _____

E. Assessment of student progress during use of learning activity package. _____

F. Assessment of student's present knowledge of behaviors to be learned. _____

G. Analyses of student competence after completion of learning activity package. _____

H. Assessment of pre-requisite knowledge and skill required of student to learn stated behaviors. _____

I. Selection of learning activity package for individual student. _____

J. Assessment of the way the student learns and his preferences for learning. _____

K. Design of learning activity package for individual student. _____

3. From your experience, check the forces you think most affect student learning. Indicate whether you think these forces are mainly positive (+) or negative (-) or no significant effect (0).

Lectures _____

Curriculum _____

Other Students _____

Teachers _____

Family pressures _____

Peer groups _____

Tradition _____

Sex _____

Drugs _____

Environmental Experiences _____

Teaching facilities (including audio-visual) _____

/ 57

4. Check the activities that show awareness of the Educational Technology process.

_____ Each student becomes emotionally involved with his own past experience of a subject. This involvement affects his response to future contacts with the subject. This must be taken into accounting in planning his programs.

_____ All students listening to a lecture will not hear the same thing because some will not be paying attention. They should be encouraged to pay attention.

_____ A teacher will give tests to find out how much information the student has absorbed, and mark according to the results (i.e., highest mark "A", and work down).

_____ A language lab consisting of 30 tape recorders and playback units is installed. Each student is given the textbook and allowed to work his way through the text and the tape recorder units. All students are required to use the laboratory.

_____ The point of testing is to enable a student to spend more time on his areas of weakness rather than his areas of strength.

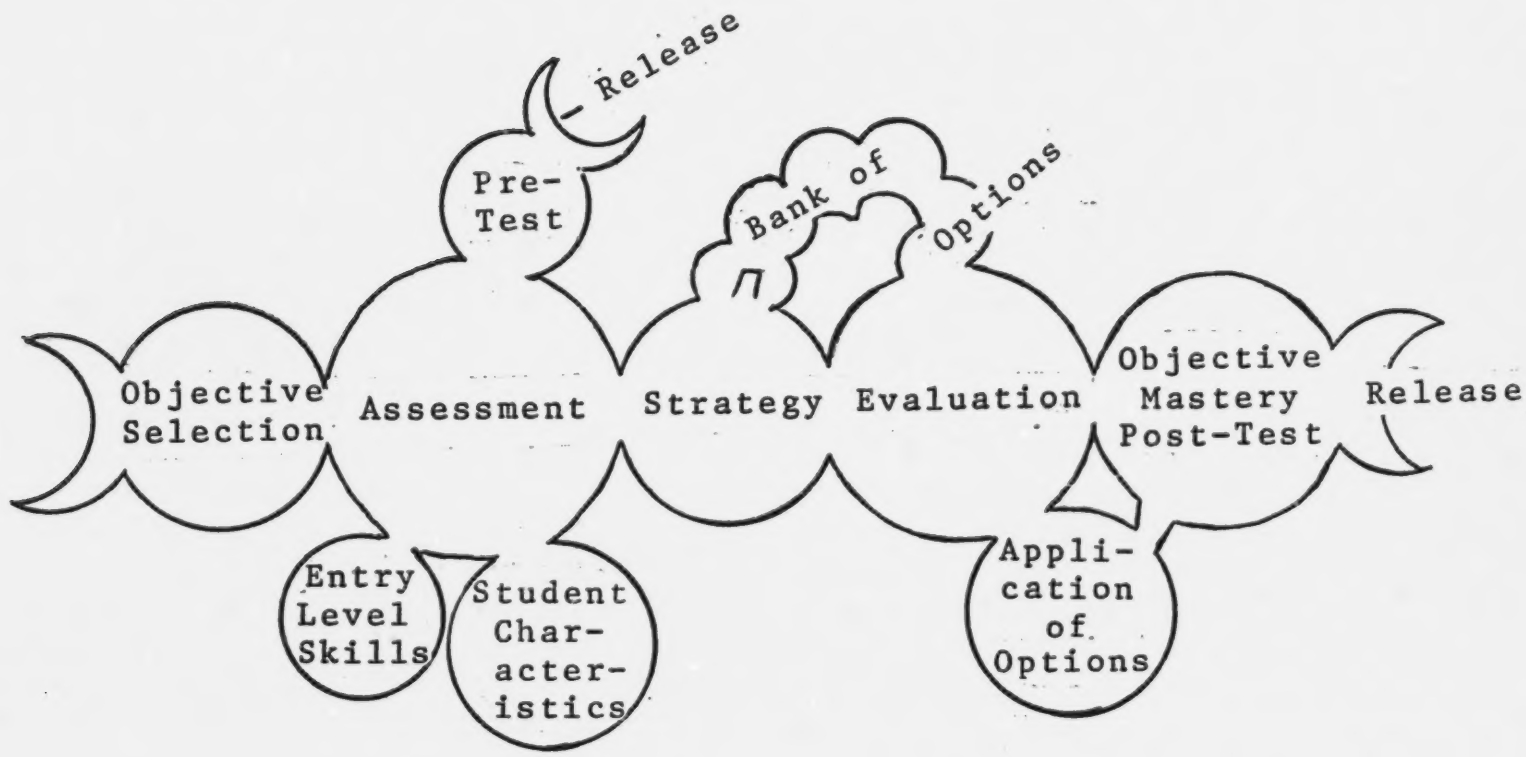
_____ A new girl enrolls in a 7th grade geography class in late October. She cannot read a 3rd grade reader. The teacher-aide is asked to work with her during geography period to help her with her reading.

_____ A lecture is meant to get across critical items of information and valuable explanations of content to all of the students.

_____ At the end of the school year all 5th graders are given criterion tests on basic skills in science. During the summer, a group of teachers and the principal work out a plan, based on the test results, for placing the 5th graders into homogeneous groups or individualized instruction.

PRE-TEST SUGGESTED RESPONSES

1. Given the picture of a learning system, and the names of its parts, label each part of the learning system correctly.



2. Each part of a learning system has a specific function. Match the name of the part to the description of its function. (Use the names given in Question 1.)

A. Multiple learning activity packages, including media.	Bank of Options
B. Comprises three analyses which describe target student population.	Assessment
C. Student exit from learning system with stated percentage competency required.	Release / 60
D. Statement of behaviors to be learned by the student.	Objective Selection
E. Assessment of student progress during use of learning activity package.	Evaluation
F. Assessment of student's present knowledge of behaviors to be learned.	Pre-Test
G. Analyses of student competence after completion of learning activity package.	Objective Mastery (Post-Test
H. Assessment of pre-requisite knowledge and skill required of student to learn stated behaviors.	Entry Level Skills
I. Selection of learning activity package for individual student.	Application of Options
J. Assessment of the way the student learns and his preferences for learning.	Student Characteristics
K. Design of learning activity package for individual student.	Strategy

3. From your experience check the forces you think most affect student learning. Indicate whether you think these forces are mainly positive (+), negative (-), or no significant effect (0).

Lectures	- +
Curriculum	+
Other Students	+ -
Teachers	+ -
Family pressures	- +
Peer groups	- +
Tradition	- +
Sex	+ -
Drugs	-
Environmental experiences	- +
Teaching facilities (including audio-visual)	+

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4. Check the activities that show awareness of the Educational Technology process.

✓ Each student becomes emotionally involved with his own past experience of a subject. This involvement affects his response to future contacts with the subject. This must be taken into accounting in planning his programs.

____ All students listening to a lecture will not hear the same thing because some will not be paying attention. They should be encouraged to pay attention.

____ A teacher will give tests to find out how much information the student has absorbed, and mark according to the results (i.e., highest mark "A", and work down).

/ 62

____ A language lab consisting of 30 tape recorders and playback units is installed. Each student is given the textbook and allowed to work his way through the text and the tape recorder units. All students are required to use the laboratory.

✓ The point of testing is to enable a student to spend more time on his areas of weakness rather than his areas of strength.

✓ A new girl enrolls in a 7th grade geography class in late October. She cannot read a 3rd grade reader. The teacher-aide is asked to work with her during geography period to help her with her reading.

____ A lecture is meant to get across critical items of information and valuable explanations of content to all of the students.

✓ At the end of the school year all 5th graders are given criterion tests on basic skills in science. During the summer, a group of teachers and the principal work out a plan, based on the test results, for placing the 5th graders into homogeneous groups or individualized instruction.

EDUCATIONAL TECHNOLOGY PROJECT

POST-

criterion assessments

THE INDIVIDUAL LEARNER

For this report only, questions 1, 2, and 4 and the suggested responses, which are identical with the pre-assessment, have not been repeated.

NATIONAL SCIENCE TEACHERS ASSOCIATION
1201 Sixteenth St., N.W., Washington, D.C. 20036

POST-TEST

THE INDIVIDUAL LEARNER

Questions 1, 2, and 4 are identical with those on the pre-test.

3. The presentation listed several forces which influence students and suggested that in traditional education these forces destroy and sometimes prevent learning. / 64

Where in the learning system described in Questions 1 and 2 would Educational Technology fit these forces so that they would augment and benefit each student's learning?

FORCE	SUGGESTED RESPONSE
Lectures	Bank of Options
Curriculum	Objective Selection & Strategy
Teaching facilities (including A-V)	Bank of Options
Other Students	Strategy
Teachers	Manager of Learning System - Application of Options Strategy
Environmental Experiences	Student Characteristics/ Strategy
Family Pressures	Student Characteristics
Peer Groups	Student Characteristics
Tradition	Objective Selection
Sex	Student Characteristics
Drugs	Student Characteristics

The following package titled Learning Pyramid was prepared by:

Writers: - Layton Mabrey
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George H. Ziener

Criterion Assessments: Peter Scott

Manuscript Coordinator: Dorothy B. Lutz

LEARNING PYRAMID

The crisis in education centers around the establishment of priorities. The system as it actually operates places the student at the low end of the priority list. The reestablishment of priorities might be based on a pyramid shaped structure with the learner at the top. Educational technology can provide the means and techniques to support each portion of the pyramid.

This is an audio tape package with a pre-post assessment.

Learning Pyramid

The following script has been written for audio tape/slide presentation. For initial validation and preparation, however, it is being presented in audio tape format only.

THE CRISIS IN EDUCATION PRIORITIES: Working Toward a Learner-Centered System

1. Today's educator is faced with a myriad of conflicting priorities:

2. Conflict rages over whether the needs of the learner, the teacher, the administrator and the public can be served equally.

3. Unfortunately the learner has been the victim of this conflict.

4. Instead of the learner's needs having the highest priorities, too often political, social and management goals have come first.

5. Today, priorities in education are given to non-learning

5. Continued.

needs such as: public relations, financing, architecture, and other peripheral matters. Only occasionally are priorities determined by the learner's needs and activities based on individual capabilities.

6. For example, why is a class day made up of six 45 minute periods? This requires a learner to turn on interest in a particular subject at the sound of a bell. Pavlov accomplished this with dogs. IS THIS WHAT WE ARE TRYING TO DO WITH LEARNING? / 68

7. Suppose the learner really gets turned on enough to continue working after the bell. He isn't allowed to; there is another class. Whose priorities are being met? Those of the learner, or of the educational system?

8. Priority is given to teaching rather than learning. A teacher assigns a problem to the entire class to be solved in three days.

9. The problem involves extensive reading.

10. Some of the fast readers can complete the assignment in two days; the slow readers will barely complete the readings in three days, to say nothing of solving the problem.

11. Why can't learning activity be self-paced? Why can't the teacher find another way of giving the slow readers the material necessary to solve the problem? / 69

12. Whose priorities come first in this situation, the student's or the teacher's? In still another case, priority is given to administrative record-keeping over individual objective student evaluation.

13. An example is that of measuring one learner against another learner's achievements.

14. Let us suppose a child is learning much that he did not know, but he has further to go to keep up with the rest of the class. Should he be failed or given a "D"? If the student is learning to the best of his ability, if he is making progress, whose needs are being met by giving him a D? Certainly not those of the learner.

15. Whose priorities are being served here, the administration's or the learner's?

16. If school exists because there are students, why hasn't education set learner-centered priorities?

17. At times education has, but in unsystematic ways which have failed.

/ 70

18. What is needed? What kind of realistic priority change can be made?

19. The existing educational priorities must be changed from teaching to learning. Inherent to our national heritage is the belief that every individual should have the opportunity to sharpen his capabilities to the full extent of his capacity.

20. What is necessary to change the priorities?

21. In addition to political and financial commitment, a wide acceptance and practice of the principles of educational technology will be necessary to develop a truly responsive learner-centered education system.

22. In this system the educational technology process designs the management techniques, the learning theory, the media and strategies using the learner's needs as the highest priority.

23. The structure of a learner-centered system can be visualized as a pyramid.

/ 71

24. A pyramid comprising three interacting systems: the learning system, the instructional system, and the educational system.

25. The base of the pyramid is the educational system: the public, P.T.A., school boards, the superintendent, planners, administrators, buildings and grounds.

26. The educational system provides the financing and the facilities. It participates in but does not solely control decisions over academic or learning priorities. Instead it supports and interacts with the instructional and learning systems.

27. Educational technology shows the education system how to efficiently analyze tasks; how budgeting, grading and scheduling, for instance, can be managed efficiently so that a truly individualized learning system can operate.

28. The next level in the pyramid above the educational system, supported by it and interacting with it, is the instructional system. / 72

29. The instructional system is comprised of the teacher, the learning materials or media, diagnostic tests, and all the other tools necessary to support the learning environment.

30. The instructional system responds to the learner's needs by diagnosing the learner, his abilities and deficiences and developing individualized strategies to provide learning activities to meet his needs.

31. Educational technology provides a process by which the instructional system can support the learner's activity by designing, testing, and validating the elements of the instructional system.

32. At the apex of the pyramid is the learner. Without him the other systems have no reason to exist.

33. The larger instructional and educational systems direct all of their activities to support the learner in his activity.

34. The learner, by interacting with the environment and materials provided by the support systems, achieves behavior he needs but does not already have--or more simply put--fulfills to a greater degree his individual capacity.

35. Educational technology integrates the systems into a true learner-centered system in which the learner's development is managed accurately, at his own pace, according to his own needs.

36. When such a system is developed by the educational technology process, it will have implications for learners of all ages.

37. Learners will be able to utilize the learning centers throughout their lifetimes as their needs dictate, not to

37. Continued.

fulfill class hour requirements or fill administration quotas, or other such irrelevant priorities.

38. Today our life-style changes rapidly, new knowledge developes more rapidly than ever before, and the learning system must adapt to these changes.

/ 74

39. The learner-centered system will fulfill this need by being a flexible resource for meeting the changing needs of the learners.

40. Can the learner-centered system be implemented anywhere or does it require special architecture?

41. In the future, it is likely that specially designed centers will exist: open twenty-four hours per day, storehouses of instantly retrievable validated materials which the learner could use at the center, or take home to use at his own pace.

42. The learner-centered system is not bound by architecture. It is a process and an approach that can be used in a prison training program, a business school, at an Air Force training base, in an academic classroom, or at home.

43. What is important is not the architecture but the learner's priorities, and the technology to meet those priorities. A learner-centered system can operate wherever the learner is.

EDUCATIONAL TECHNOLOGY PROJECT

76

PRE-

criterion assessments

LEARNING PYRAMID

For this report the desired responses have been included on the sheet opposite each question.

NATIONAL SCIENCE TEACHERS ASSOCIATION
1201 Sixteenth St., N.W., Washington, D.C. 20036

PRE-CRITERION ASSESSMENT

SET II PACKAGE LEARNING PYRAMID

DATE _____ NAME _____

STIMULUS	RESPONSE
1. Would you agree that a major question in education today concerns the priority of the learner's needs in relation to those of the teacher, administrator, and public?	Yes / 77
2. In ranking the following segments of education in the decreasing order of priority they <u>actually</u> hold in the schools, where does the student or learner rank? Public Student or Learner Administration Teacher	4th. (at the bottom)

PRE-CRITERION ASSESSMENT

SET II PACKAGE LEARNING PYRAMID

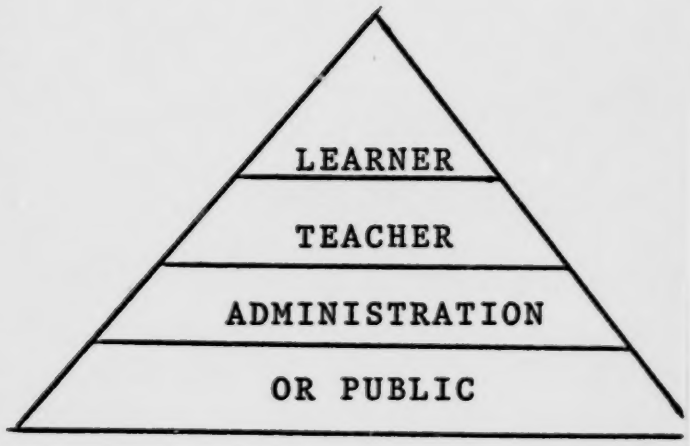
DATE _____ NAME _____

STIMULUS	RESPONSE
3. Place the segments above in decreasing order of priority as you feel they should be arranged.	1st - Student or Learner 2nd - Teacher / 78 3rd - Administration and Public.
4. The teacher assigns her material all at once, teaches and tests all the learners in the same way and at the same time. Whose priorities are being served here? Explain.	The teacher's. It is easier to work with all the learners as a group rather than plan with them as individuals.
5. A class day is made up of 6 45-minute periods. Whose priorities are being served here? Explain.	The administration's. It is easier to schedule all the students in set periods as a group than devise individual schedules.

PRE-CRITERION ASSESSMENT

SET II PACKAGE LEARNING PYRAMID

DATE _____ NAME _____

STIMULUS	RESPONSE
6. The school has to restrict its program and schedule half-day sessions. The students learning program must be compressed into a half-day. Whose priorities are being served here? Explain.	The public's. It is easier to cut the school's program than find more efficient public financing of schools. / 79
7. Draw and label a pyramid which conceptualizes learner-centered system of education.	

PRE-CRITERION ASSESSMENT

SET II PACKAGE LEARNING PYRAMID

DATE _____ NAME _____

STIMULUS	RESPONSE
8. In the learner-centered system of education what function does educational technology have for the following: a) Administration & public b) Teachers c) All three, administration and public, teachers and learners.	a) Educational technology assists the administration and public in analyzing / 8(budgeting tasks, building design, scheduling requirements and support facilities so that learner's needs have first priority. b) Educational technology allows the teacher to diagnose and design strategies to assure that the learner's needs have first priority. c) Educational technology integrates the three systen so that the individual learner's needs are managed accurately and efficiently.

EDUCATIONAL TECHNOLOGY PROJECT

POST-

criterion assessments

LEARNING PYRAMID

For this report the desired responses have been included on the sheet opposite each question.

NATIONAL SCIENCE TEACHERS ASSOCIATION
1201 Sixteenth St., N.W., Washington, D.C. 20036

POST-CRITERION ASSESSMENT

SET II PACKAGE LEARNING PYRAMID

DATE _____ NAME _____

STIMULUS	RESPONSE
1. Explain why a "PYRAMID" effectively represents the structure of a LEARNER-CENTERED system of education.	The pyramid shows the learner at the top being supported by all the other sub-systems of education; the teachers next to the learner because they are responsible for his goals and most responsive to his needs; supported in materials, etc. by the public and administration who decide the foundation of educational priorities. All sub-systems interact but are focused toward the learner. /82

POST-CRITERION ASSESSMENT

SET II PACKAGE LEARNING PYRAMID

DATE _____ NAME _____

STIMULUS	RESPONSE
2. a) Given the following example whose needs are not being met? b) Will it be a positive or negative effect on this group? Example: Under pressure from parents a school's administration institutes a Dress and Grooming code. Students are expelled and receive "0"'s for enforced absences.	a) Learner b) Very negative /83
3. Using the example in the previous question describe a process which might change the priority to the learner's needs.	Involvement of students in developing the code.

POST-CRITERION ASSESSMENT

SET II PACKAGE LEARNING PYRAMID

DATE _____ NAME _____

STIMULUS	RESPONSE
4. Give specific examples showing how educational technology might function with the instructional system in creating a learner-centered system of education.	Educational technology shows the instructional system how to diagnose learners, how to manage their learning behavior so that it suits their needs, and how to verify that learning has taken place. /84
5. What function would educational technology have with all three systems: learning, instruction, and education sub-systems in creating a learner-centered system of education?	Educational technology integrates the three systems so that the learner's needs have first priority and are managed efficiently and accurately.

The following package Closing the Loop
was prepared by

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Photography: Layton Mabrey /85

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Manuscript Coordinator: Dorothy B. Lutz

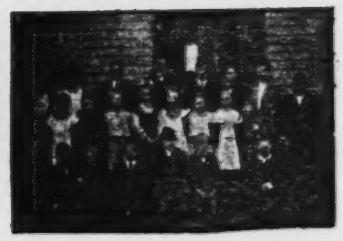
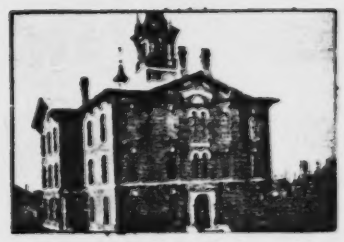
CLOSING THE LOOP

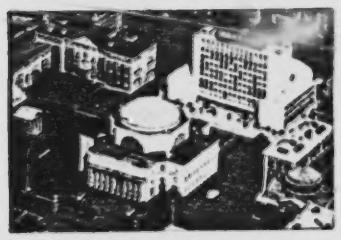
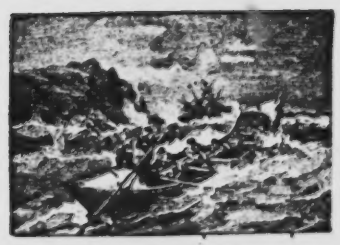
The evolution of American education from rural simplicity to urban complexity, both in actual location as well as learning needs, is traced on a historical basis. Many of the new needs, such as changing classroom structure are being met but more needs to be done. /86

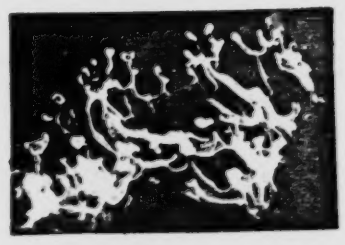
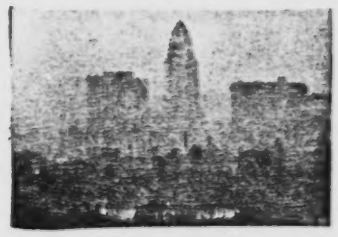
Educational technology is not many things or approaches, but it is a coordinated systematic approach to our changing educational needs. Emphasis here is on the need for open-endedness in any approach. The solidarity of the system should not become rigid.

This package is an audio tape/slide presentation with a pre-post assessment.

Closing The Loop

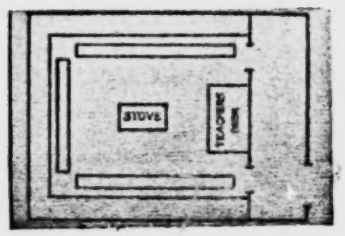
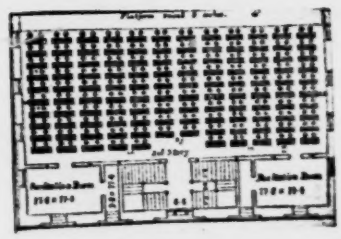
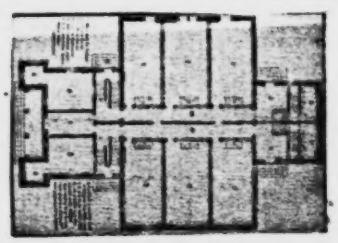
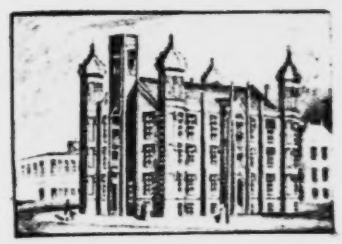
SOUND	VISUALS
1. I've experienced a lot of education in what has been a near lifetime....	
2. ....coming out of rural America, a pretty lucky fellow....	
3. ....from the one-room school-house....	
4. ....to the new consolidated district school made of brick, with drinking fountains and inside toilets that flush....	

SOUND	VISUALS
5. ....from high school to war.... and return....	
6. ....on to the university.... graduation....then returning as a working faculty member....	
7. ....but there were others who came before....and to review some of those early American beginnings may provide us with an <u>appreciation of where this thing called educat-ional technology can lead us</u>....	
8. ....New educational methods and applications have been laggardly adopted in our school systems.	

SOUND	VISUALS
9. ....two and a half centuries of tradition are not easily broken.... but it has to happen....	
10. ....the 19th-in-a-20th century educational bubble has burst....	
11. Modern society demands a different approach and a restructuring of the educational system to meet today's needs....	
12. ....Our agrarian beginning was difficult for American education....	
13. ....but the highly urbanized educational picture of today is perhaps an even greater embarrassment....	

/89

SOUND	VISUALS
14. ....the shift from agraria to urbania represents a social migration which is still in process....	
15. American education borrowing heavily from her European heritage, stood firmly on her pedestal....only slowly did the concept of education for <u>all</u> become a kind of reality....	
16. ....even more important, education of the elite and of the urbanite, just as in Europe, bred a rural/ cosmopolitan gap which was to persist and eventually form <u>a kind of environmental isolation which may be at the heart of much of our educational dilemma today</u>....	

SOUND	VISUALS
17. ....But we moved on, we Americans. From the school of colonial times, usually a single room arrange-ment....	
18. ....to the Lancasterian large room monitoring system, and addition of recitation rooms....	
19. Rooms and more rooms, rectangular at first, then stacked on top of each other....the "box on box" concept grew across the nation....	
20. Consolidation became the keynote and up went the brick and gingerbread facade edifices of learning. But facades do not mean that learning experience is necessarily occuring within....	

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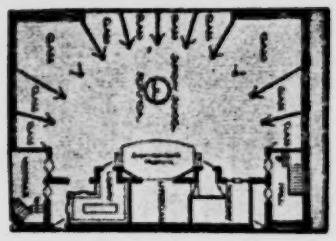
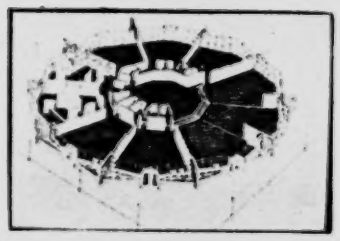
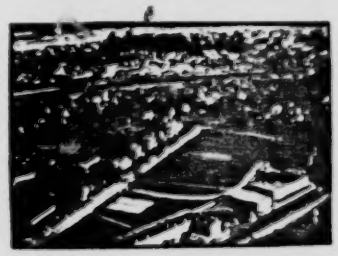
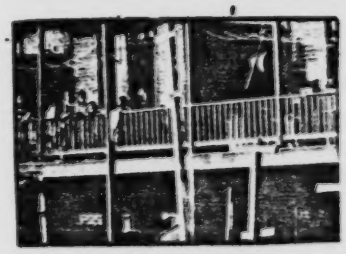
SOUND	VISUALS
21. Some interesting church designs, taking into consideration other than rectangular forms, opened the way for a more flexible treatment....	
22. ....a treatment which is reflected in the work of many of our contemporary school architects....	
23. ....traditional rural attitudes and rural living patterns were forced into the cookie-cutter like patterns of the city....and these were not all GOOD patterns by any means, WERE THEY?	
24. Education's problems are manifested in the frustration of ghetto BLACK....	

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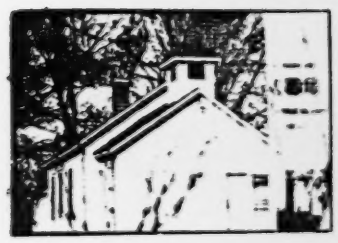
SOUND	VISUALS
25. ....migrant labor BROWN....	
26. ....mountain WHITE....	
27. ....and reservation RED....	
28. The school in the village or in the corner of the forest lot is fading fast....the trend to the city appears to be almost irreversible....the statistics imply this....	

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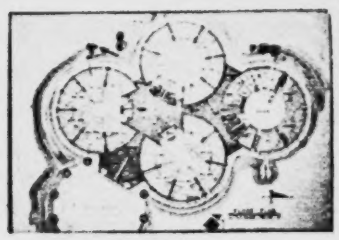
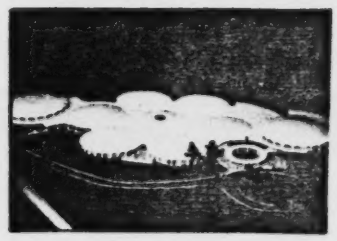
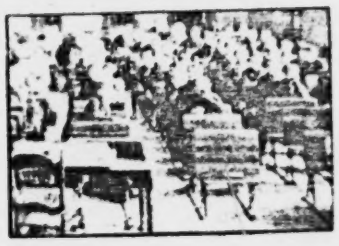
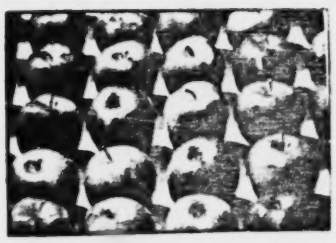
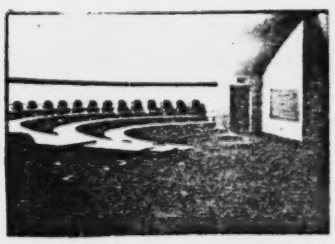
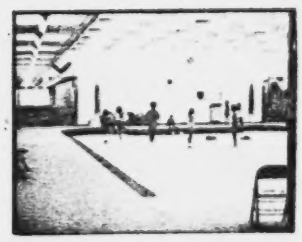
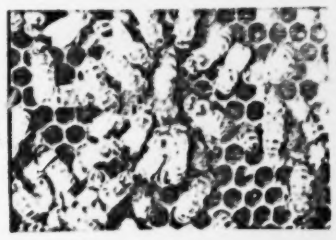
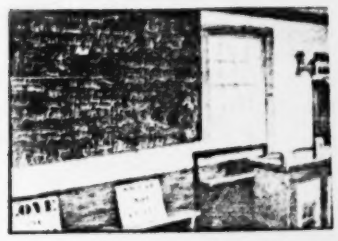
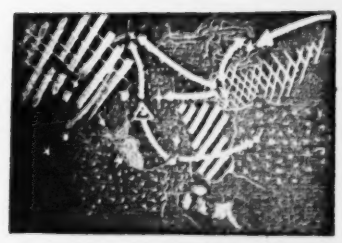
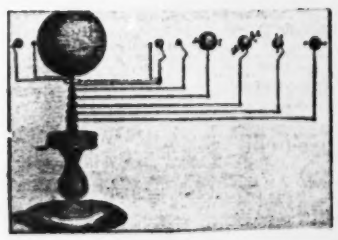
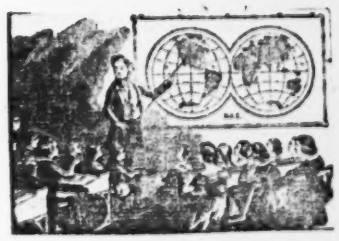
SOUND	VISUALS
29. ....the real tragedy is that today's young people are caught up in an ENVIRONMENTALLY induced ISOLATION.	

30. ....but there are promising indications of a departure from <u>hard rectangular thinking and planning</u>.	
31. While "learning experiences" do not grow entirely out of physical changes, the anti-traditional forms being developed by more imaginative designers, and the fact that these forms are being encouraged by many school administrators, suggests the "box on box" concept is changing.	

SOUND	VISUALS
32. ....from "head of the class-room"....	
33. ....apples boxed in rows....	
34. ....to "T" and "U" and other imaginative arrangements	
35. from the bolted-down row desks....	
36. ....to flexible and more effective communication arrangements....	

SOUND	VISUALS
37. a shift from lecture patterns to innovative groupings,	
38. from the blackboard of the 1830's....	
39. ....to the magnetic chalk-board of today in grays, reds, blues, greens, and whites,	
40. globes, maps, and orrerys have not changed much....	
41. ....of course history, and geography, and man's point of view have....	

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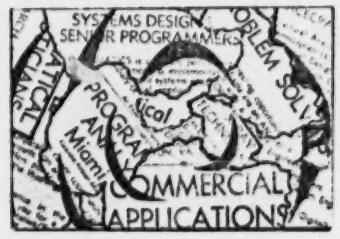
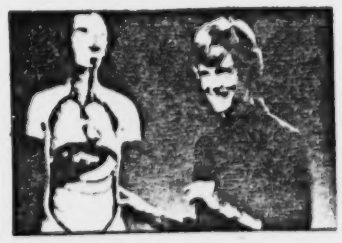
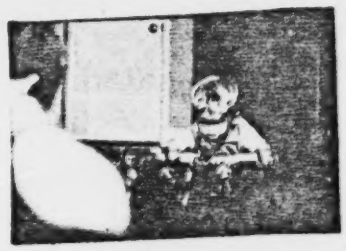
SOUND	VISUALS
42. ....what with the Moon's-eye-views we now have from both near and not-so-near space.	
43. The newspaper, still with us, serves the public with a broad assortment of classified ads and bathing beauties....but other media have put news reporting on a "watch and hear while it happens" basis....	
44. from pickled cadavers to the frozen....with a host of plastic "almost-but-not-quite-real" polyethylene models.	

SOUND	VISUALS
45. Joe, the skeleton who danced in the corner of the one-room school has all but been replaced....	
46. ....by a plastic take-it-home plaything....something you can buy at the local hobby shop for five bucks.	
47. Today's child, at five or six, already knows much about the world....the distant world....	
48. His immediate world, perhaps not so well.	
49. Of course there is always that difference between <u>knowing</u> and <u>cleverness</u>; understanding and intelligence....why more today?	

SOUND	VISUALS
50. Because a multitude of media have been working on these children from the first toy robot....the first plastic cannon on....	
51 ....the message is buried in the medium....it may convey a sense of peace, and hope and light as with a doll....or	
52. ....bang bang war and "kill'em darkness....	
53. ....with plastic toy bodies and cannons all too soon becoming the real thing....	

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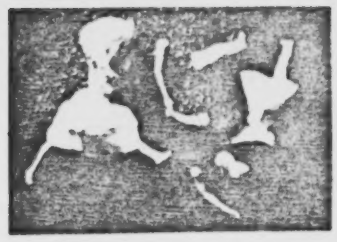
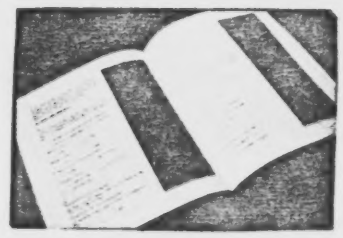
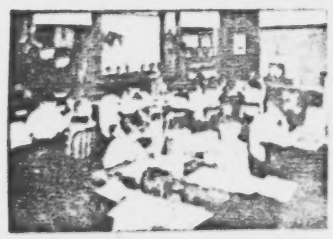
SOUND	VISUALS
54. ....this learning by proxy (experience) while quite dramatic does not fully prepare our young men and women to cope with the blood and flesh business of living in the real world.	
55. While earlier school texts served well in their time, today's printing and illustration technology has come a long way since the original McGuffey's Reader....	
56. Today's text has incorporated visuals with linear and branching programs....the result, programmed instructional packages.	
57. Individualized instruction, a learning approach, first tried out in the 1920's, today includes utilization of programmed instructional texts....	

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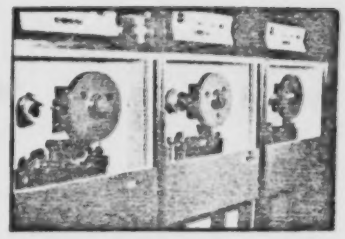
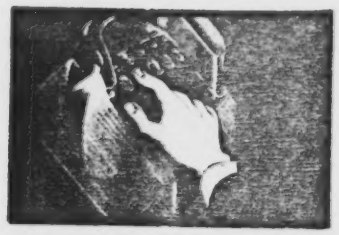
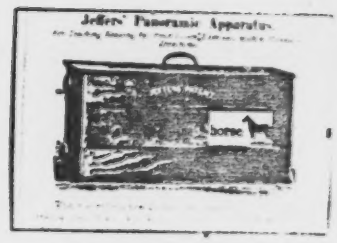
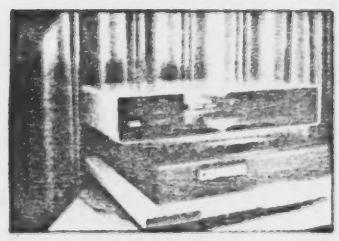
SOUND	VISUALS
58. ....along with other programs locked in computers hundreds of miles away....ready for release at the dial of a number.	
59. The raised hand response mechanism of yesteryear's student....	
60. ....has become a battery of press button options....	
61. Jeffer's Panoramic teaching device of the 1870's....	
62. ....has evolved to a passing review of mechanical, optical, electronic equipage, and computerized typewriters.	

SOUND	VISUALS
63. Hundred and fifty thousand dollar page turners and flip charts we hear some people say....But remember that today's child is growing up in a world of fast change, reinforced by industry....	

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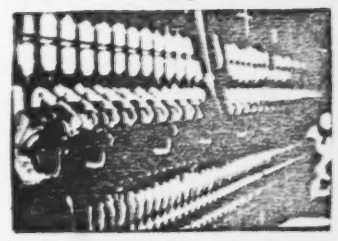
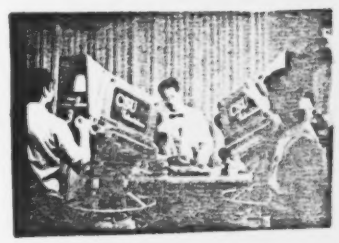
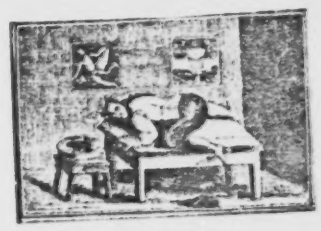
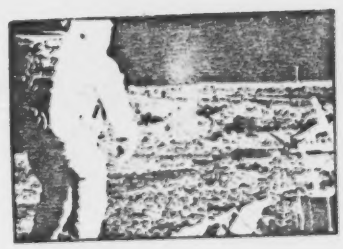
64. ....after all, a vast majority of today's instructional media came out of software and hardware designed more for Business and Industry than for Education.... and this spells trouble for today's educator.	
65. ....ETV, ITV, CCTV, CATV, TVTV.... Communication vehicles all with great instructional promise, yet for the most part, still embracing traditional motion picture production techniques....	

SOUND	VISUALS
66. Simulation has a big part to play in today's educational arena.... Man has used this technique down through the centuries....Lord Chitterton, by mimicing the movements of a frog in a basin of water, learned to swim, <u>in theory at least</u>....	
67. Armstrong, the American astronaut, worked through a number of simulations....including the swim.... important in getting the feel of working in a weightless environment.	
68. The moon journey could not have taken place without the aid of the computer....Big business and big education have put substantial emphasis on this tool....Yes and lots of money too....	

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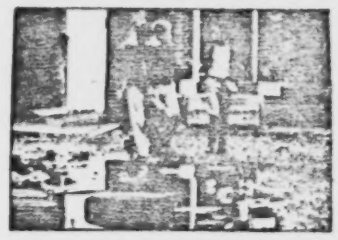
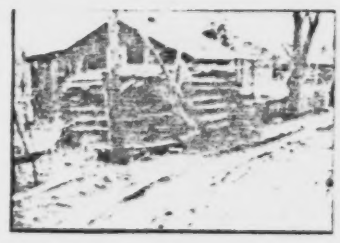
SOUND	VISUALS
69. Down the alley, Johnny, Jimmie, and Mario kick a beer can to Public School #9, a multi-room new construction with an auditorium, heavily barred windows, and a blacktop play-ground....	
70. ....or only two or three hundred miles from the city, up in the mountains, country kids cross over rock filled Skunk Hollow and on to a one room School #10, sans flush toilet, sans auditorium, and a very different kind of playground.	
71. Out in the middle of all this, is the TEACHER....	

SOUND	VISUALS
72. from bustled Mary Stover, Normal School graduate, at the turn of the Century....	
73. ....to mini skirted Jenny Ross, University of Missouri graduate with a Masters Degree.	
74. Jenny, caught in the midst of educational challenge....drawn by tradition on one hand and tempted by some new, perhaps innovative, practices on the other.	
75. How to help Jenny and her contemporaries become better teachers? How to help them develop a confidence in managing the new and available teaching media beyond that of the textbook and lecture?	

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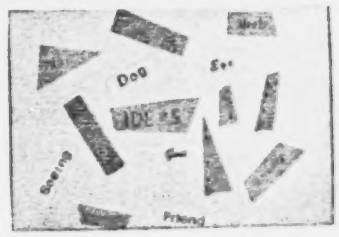
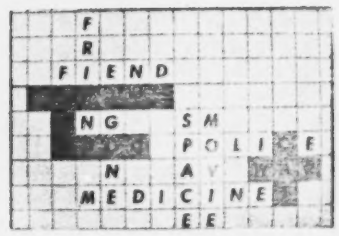
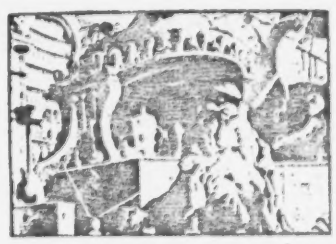
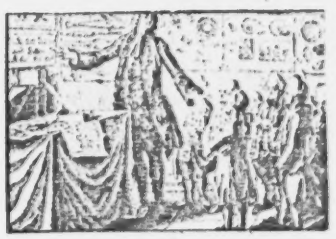
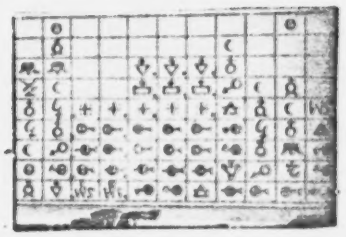
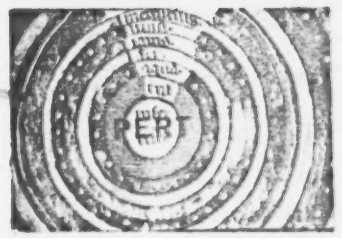
SOUND	VISUALS
76. How to develop in students the ability to conceptualize....to extend FACTS into IDEAS?	
77. How to develop in students, a keener SCIENTIFIC LITERACY which will be a prime ingredient in the process of VALUE DETERMINATION.... OF SURVIVAL.	 /106
78. Educational Technology offers a better way of getting down to the business of guiding students through learning experiences, which will develop that scientific literacy.	
79. Yet, the alchemist of old is still with us....the client must choose between the real gold and fool's gold....Educational technology is engulfed in a number of miscon- ceptions.	

SOUND	VISUALS
80. We must remember that E.T. is not machinery.	
81. ....E.T. is not audiovisual equipment.	
82. ....E.T. is not teaching aids.	
83. ....E.T. is not software.	
84. ....E.T. is not PERT....PERT is Program Evaluation and Review Technique.	

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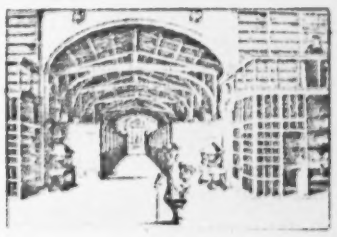
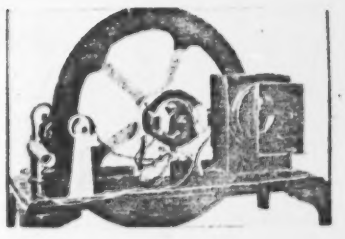
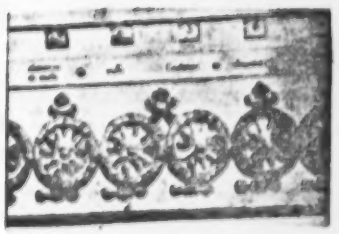
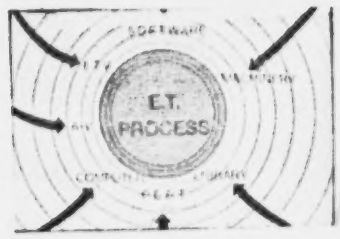
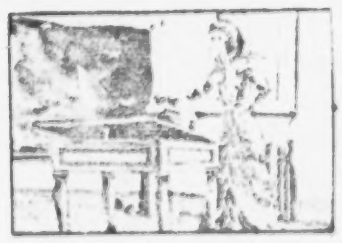
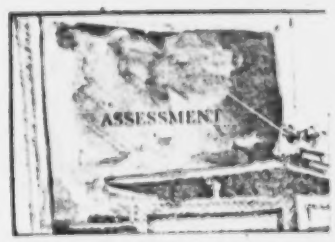
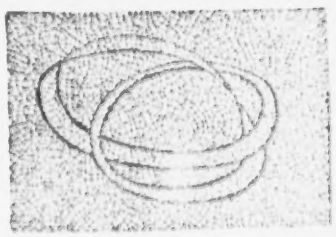
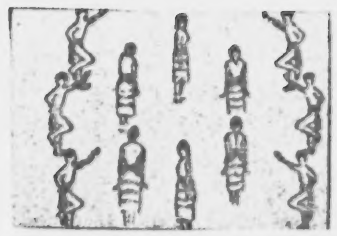
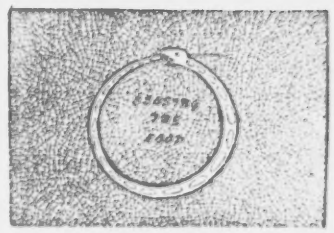
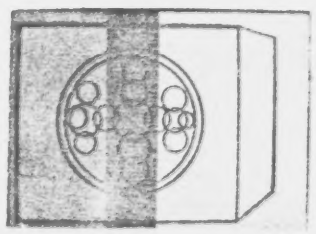
SOUND	VISUALS
85. ....E.T. is not a modern library.	
86. ....E.T. is not an information center.	
87. ....E.T. is not ETV.	
88. Educational Technology is not a computer program where Johnny can phone in and for the price of a hamburger, experience a twenty minute run through a set of math or history exercises.	

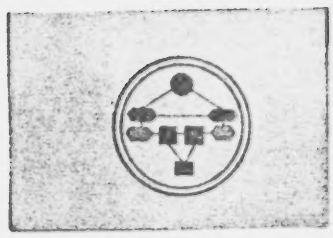
/108

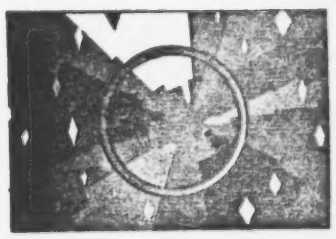
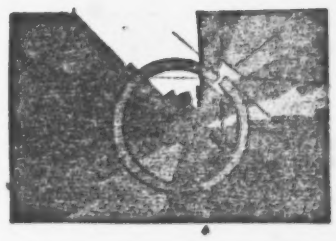
SOUND	VISUALS
89. Educational technology <u>utilizes these individual things, but only as part of the entire educational technology process</u>.	
90. <u>Effectively applied, educational technology , as a creative management process with student learning as the final purpose</u>, can help Jenny, her peers, and her supervisors.	
91. Mary Stover, who at the turn of the century taught students in a six grade, one-room school, could grasp the educational technology concept far more easily than the teacher of today....	
92. ....For Mary, out of necessity, not choice perhaps, but necessity,	

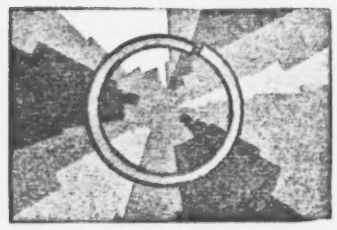
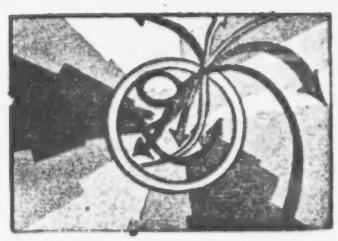
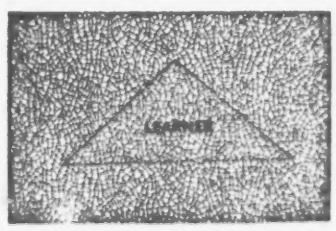
SOUND	VISUALS
92. Continued. had to be an efficient manager. Today we're in the middle of "specialization" and the changing of one's role is not easy.	/110
93. What Mary Stover did more or less by hunchmanship, reinforced through hard experience, the educational technology process does through a more scientific approach....	
94. Starting with the determination of a set of specific learning objectives to be mastered....	
95. ....a careful study of the nature of the learner....	

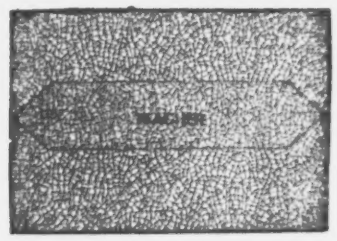
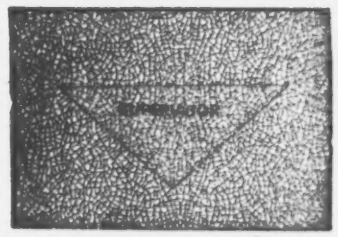
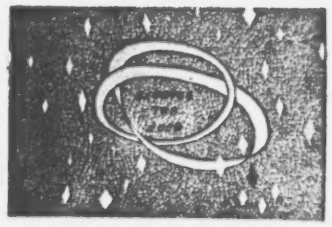
SOUND	VISUALS
96. ....guidance of the learner through a sequence selected from a bank of sequences made available to the teacher.	
97. ....monitoring of the student's progress through the learning sequence....redirecting him if necessary....	/111
98. ....the use of teaching materials which have been put to test and proven to work....	
99. ....and testing of the student to determine how well he has mastered the objectives.	
100. ....striving for closure in the learning process, may very well	

SOUND	VISUALS
100. Continued. become paramount in the thinking of some educators committed to the educational technology approach.	
	/112
101. The concept of the "closed loop" has been with man down through his history. He gravitated to a circular configuration as soon as he bagan to form his first social structures....	
102 ....In some cultures the serpent with tail in mouth became a graphic symbol of the universe.	
103. Today there are those involved in curriculum development and in educational technology who	

SOUND	VISUALS
103. Continued. see the ideal learning system designed as a set of subloops within a master loop....	
104. ....systematically developed....	 /113
105. ....even tested by a scientific methodology....	
106. ....all neatly wrapped in a package....ready for use....	
107. ....But is a "closed loop" really the ideal objective....IS THERE NOT A REAL DANGER IN THIS THINKING?	

SOUND	VISUALS
108. A completely closed system stands as a barrier from which a lot of serious learning and serious thinking cannot grow....it limits the expansion of concepts and discourages the discovery of new ones....	/114
109. ....<u>a lot of important creativity</u> and a lot of important innovative activities cannot occur in <u>Closed Systems</u>.	
110. Educational Technology, by applying scientific principles to management and by designing systems as on-going processes, can incorporate spark-gaps in those designs where much learning and thinking just may take place.	

SOUND	VISUALS
111. Unless the learner relates that which he is experiencing within the learning system to the reality beyond, there is little chance he'll succeed in bridging the FACTS--to CONCEPTS--to VALUES gap that apparently exists in the American educational community today.	 /115
112. The Educational Technology process is similar for all those involved in its design production, or utilization aspects; it serves as a three-faceted attack on today's problems by:	
113. ....providing a "know where I stand" base for the LEARNER,....	

SOUND	VISUALS
114. ....stimulating and helping to develop a more significant <u>Management</u> role for the TEACHER,....	
115. ....advancing a framework which the Science Supervisor may use to engender an innovative environment, at all levels of education.	 /116
116. KEEP THE SPARK GAP THERE. Educational Technology provides the educator a way to "get through the learning barrier."	

EDUCATIONAL TECHNOLOGY PROJECT

PRE-

criterion assessments

CLOSING THE LOOP

For this report only the desired responses have been included on the sheet opposite each question.

NATIONAL SCIENCE TEACHERS ASSOCIATION
1201 Sixteenth St., N.W., Washington, D.C. 20036

PRE-CRITERION ASSESSMENT

SET II PACKAGE CLOSING THE LOOP

DATE _____ NAME _____

STIMULUS	RESPONSE
1. Name three forces in the history of American education which have <u>inhibited</u> change.	a) The persistence of the self-contained classroom. b) The change from rural to urbanized education. c) The almost exclusive continued use of print media, mainly textbooks. /118
2. Name three areas in American education that you feel are most critically in need of change	No specific answer desired since this is really an opinion question. However, there should be three areas listed.
3. From your own experience, name three factors in American education which you feel have contributed to the "environmentally-induced isolation" felt today by so many young people.	a) Urbanization of education. b) Self-contained classroom. c) The concept that all students are alike.

PRE-CRITERION ASSESSMENT

SET II PACKAGE CLOSING THE LOOP

DATE _____ NAME _____

STIMULUS	RESPONSE
4. From your own experience, list at least three ways in which the educational system in the U.S. has failed to cope with the "mass media child" of the 1960's.	a. Failure to recognize the isolation produced by TV: The child knows more about the external world, but less about /119 himself. b. Learning vicariously, through close contact with mass media, does not prepare the child adequately to cope with "real life situations." c. Failure to widely incorporate "technology" into education; the child is overwhelmed by it but not made to feel comfortable with it.

PRE-CRITERION ASSESSMENT

SET II PACKAGE CLOSING THE LOOP

DATE _____ NAME _____

STIMULUS	RESPONSE
5. Name three trends in education today in the United States and relate each to educational technology as you now understand it.	a) Change from traditional rectangular shape to round and other shapes for schools and learning areas. /120 Educational technology advocates more effective learning arrangements, such as large, "open-area" classrooms as conducive to more effecient learning. b) "T" and "U" shaped meeting arrangements. The behavior of students resulting from new communication patterns is of vital concern to educational technology. c) Getting away from the lecture method to the use of other learning resources. Students learn in different ways, not all students will learn effectively from the lecture. They need to have options.

PRE-CRITERION ASSESSMENT

SET II PACKAGE CLOSING THE LOOP

DATE _____ NAME _____

STIMULUS	RESPONSE
6. Check any of the following items which you consider to be part of educational technology or that concerns itself with E.T.	/121
1. Learner-centered instruction	X
2. Norm Referenced testing	X
3. Behavioral objectives	X
4. Students	X
5. Self-contained classrooms	
6. Criterion tests	X
7. Pre and Post tests	X
8. Diagnostic testing	X
9. Lectures	
10. "T" and "U" shaped seating arrangements	X
11. All students are alike concept.	
12. Grading on the curve	
13. Validated instructional materials	X
14. Blueprints for a new school	X
15. School budget for current fiscal year.	X

PRE-CRITERION ASSESSMENT

SET II PACKAGE CLOSING THE LOOP

DATE _____ NAME _____

STIMULUS	RESPONSE
7. List at least three ways in which educational technology proposes to effect change in the educational system of the United States.	a) Change the role of the teacher from primary information source to manager of many learning resources. b) Use of a scientific approach to the learning process, including: 1) establishment of individual learning objectives, /122 2) a study of the individual learner and assessment of his needs 3) creation of a variety of learning paths through a particular instructional sequence, 4) continual evaluation of the student based on feedback, 5) continual validation of learning materials used. c) Emphasis on each learner as an individual.

EDUCATIONAL TECHNOLOGY PROJECT

POST-

criterion assessments

CLOSING THE LOOP

For this report only questions 1, 4, 5, 6, and 7 and the suggested responses, which are identical with the pre-assessment, have not been repeated.

NATIONAL SCIENCE TEACHERS ASSOCIATION
1201 Sixteenth St., N.W., Washington, D.C. 20036

POST-CRITERION ASSESSMENT

SET II PACKAGE CLOSING THE LOOP

DATE _____ NAME _____

STIMULUS	RESPONSE
Questions 1, 4, 5, 6, and 7 and the suggested responses are the same as on the pre-assessment.	
2. On the pre-test you were asked to name three areas in American education which you felt needed to be changed. How has your thinking changed regarding this question since seeing the Closing the Loop presentation?	No specific answer desired since this is really an opinion question. /124 It is hoped that at least their thinking would be a little clearer now.
3. On the pre-test you were asked to name three factors in American education which have contributed to the "environmentally-induced isolation" felt today by so many young people. Compare your answers to those you made before you saw the presentation. Briefly justify any changes.	

The following script titled Production
was prepared by

Writer: Layton Mabrey

Audio: Douglas Boyd

Editing & Revision: Dr. Gabriel D. Ofiesh
Clarice Leslie
George H. Ziener

Manuscript Coordinator: Dorothy B. Lutz

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PRODUCTION

Today in most technologies, problem analysis and problem solving is conducted by a team of men representing various skills.

Applying this systems approach to American education is another precondition to achieving a learner-centered system of priorities. /126

This package discusses the characteristics of production and the structure and activity of the production team. The need for a team and its specific activities are presented within the various elements of a systems structure.

The package is an audio tape presentation.

Production

The following script has been written for audio tape/slide presentation. For initial validation and preparation, however, it is being presented in audio tape format only.

1. A grab bag of instructional materials: in one catalog alone, 10,000 films on the subject of scienc; a mass of materials representing a "kind of rorschach experience" from which various kinds of behavior may be elicited from a student by the "creative" teacher. /127

2. But this is not the situation: most teachers do not normally have the time nor expertise or training necessary to integrate these materials into viable individualized learning systems.

3. Educational technology, as a process, applies a systematic approach in searching out effective material, develops additional inputs, and constructs a valid, empirically-tested learning system;

4. a system for variable-sized group learning situations, but always specifically designed to accommodate the needs of the individual learner.

5. These validated, multimedia self-instructional systems all have the consistant characteristic of presenting information in segments organized to guide the learner to a specific learning end, under specific conditions.

6. Materials which make up this type of system must be tested and validated in order to meet their purpose.

/128

7. That purpose: To provide a learning situation with optimum effectiveness and efficiency for the learner.

8. And so, the <u>big</u> question is "who is to produce this learning system?"

9. Development of these learning systems is a major role of the educational technology process. Production is a task perhaps better undertaken by a group than an individual.

10. Some rare individuals possess all the skills necessary to design and produce a complete system, but in most cases the sum of these skills is possessed by a team of individuals.

11. A production team may consist of one or two persons, or as many as 15 or 20. The important thing is that the

requisite production skills are present, not a given number of people.

12. Major skills and characteristics that must be included are:

13. • coordinator/administrative type of person experienced in management and budgeting;

/129

14. • a learner or learners carefully chosen to represent the ultimate audience and readily available for empirically testing instructional units as they are developed;

15. • a content or subject matter specialist for input of facts, ideas, and trends in content development, but above all to certify to the technical accuracy of what is being taught;

16. • a curriculum specialist to serve as a necessary liaison between the educational system and the production team, a professional highly versed in the latest concepts of curriculum design in order to advise how to organize the sequence of his function and fit the learning strategies into the overall curriculum. Therefore, along with being a curriculum specialist he also should be a subject matter specialist;

17. · a behavioral psychologist to provide information in learning theory and practical learning strategy design;

18. · a media and communications design specialist to direct communications and message design, as well as media development for practical application to learning; /130

19. · one or more teachers to direct the management of instructional level, and possibly direct the validation activities when the system is put in the field;

20. · a talent pool to provide a wide number of specialities which may be drawn upon as needed. For example: Content specialists in other fields, systems analysts, programming specialists, script writers, graphic artists, management specialists, narrators, statisticians, counselors, sociologists and possibly even bio-chemists.

21. These skills make up the production team: a corporate systems effort which, from this point on, will be known as the PRODUCTION UNIT or team.

22. It is necessary to recognize that the production unit does not necessarily have to be made up of many individuals. What is important is that the team contain the variety of competencies and/or skills mentioned above.

23. Conceivably, a curriculum specialist may also be quite competent in the field of behavioral system design. /131
With this combination of skills he can plan the sequence of instruction, determine the learning strategies, perform the task analysis, and also develop appropriate diagnostic and criteria instruments to assess learning results.

24. The exact number of individuals and specific structure of the production unit will vary depending upon which of the three major approaches is taken in production of a particular system.

25. The areas or types of activity of the production unit may be summarized briefly:

identification

adaptation

creation

26. There are a growing number of available materials being developed which utilize a systems approach. Initially the production unit has the duty to identify, assess, and utilize these materials.

27. In most cases, however, available learning material must be adapted and augmented in order to produce a learning system. Cost for this activity varies depending upon the amount of work the production unit must do. /132

28. Creation "from scratch," although a demanding and expensive process, may in many instances be the most effective process. Here, the production unit has complete responsibility for the ultimate learning produced.

29. Any type of activity in producing a learning system should always approach learning as an ongoing process rather than a fixed product.

30. Any learning system produced is first a "pilot" program until it is validated on the actual learning population for which it was designed.

31. The validation process involves the entire system: objectives, media, management, bringing feedback to the production unit. Revisions, further validation, and further revisions are then made until the "polished package" is ready.

32. How is this process developed?

33. Basically, by using a systems approach to design the learning system. /133

34. This means specific identification of the task, both in terms of learning outcomes and student population.

35. Learning outcomes or terminal objectives specify the behavior the learner is expected to demonstrate after having worked through the learning system.

36. Ideally all members of the team including learners should be in on selection of objectives.

37. Objectives, to be meaningful, must be tightly constructed, written in clear and concise terms that can be measured to determine whether they have been attained.

38. A fundamental tool for measuring attainment of objectives is the criterion referenced test by which the learner demonstrates his mastery of the specified learning objectives.

39. Criterion referenced testing defines the objectives operationally. Among other things it measures the degree (0---to---100%) to which the Learner has attained the prescribed learning objectives. /134

40. ---

For those supervisors who desire more information on this testing method, an audio/tape package is available for individual use. Title: "Criterion Referenced Testing vs. Norm Referenced Testing." Run through time approximately 15 minutes.

---

41. For each set of terminal objectives used in the system, the production team must prepare a set of criterion-type and retention tests.

42. Post-tests are used to measure objective mastery, after the Learner has gone through the learning system.

43. The retention test measures, at some later date, the amount of learning the student retains. Usually this is accomplished by later learning which builds upon earlier outcomes.

44. Tests, as well as learning strategies, should be analyzed and perhaps revised into a more effective communications design, utilizing other-than-print media.

/135

45. Testing does not have to be relegated to paper-check-lists or response sheets. A wide variety of media can be used for testing and simulation activities that in themselves serve not only for reinforcement and extention of learning, but also as assessments of student progress.

46. Once the objectives and criterion assessments are developed, the production unit must identify certain characteristics of the student population: entry level skills, learning characteristics, and degree of attainment of the terminal objectives.

47. The means of arriving at this information is through development of diagnostic tests which are a very common sense approach to arriving at an understanding of the individual learner.

48. This activity is development of diagnostic tests and is a very necessary and common sense approach to arriving at a better understanding of the individual learner for whom the learning materials are being produced. Out of this procedure we expect a considerable amount of insight and empirical evidence which may well become the basis for our learning strategy design.

/136

49. Diagnostic tests are of two kinds: The mastery pre-test and entry level tests which consist of the prerequisite knowledge and skills and the learning characteristics units.

---

50. A full development of diagnostic testing, is contained in the Level II package - Diagnostic Testing - Run through time, 15 minutes.

---

51. Results of the diagnostic tests, when correlated, will produce a set of generalizations as well as very specific strategy information. Now the team has a base from which to prepare a TREATMENT or STRATEGY OUTLINE.

52. Learning strategy, as we use it here, is a process developed to aid the learner in changing his behavior from his entry level to behavior specified in the objectives.

53. A master learning sequence, or core of learning events, is designed to accommodate the needs of the majority of the learner population.

54. Paralleling this sequence, a number of OPTIONAL LEARNING SEQUENCES are developed; sequences designed to accommodate the accelerated or the slower members of the learning population.

137

55. For those students above the master sequence, an enrichment activity can be used or they can be sent on to more advanced master sequences.

56. For those below the master sequence, the entry level test determines their needs and special sequences or earlier master sequences can be used.

57. Dr. Robert Gagné advances a set of six instructional events which should be developed in a learning strategy:

58. • gaining and maintaining attention;

59. • insuring recall of previously acquired knowledge;

60. • guiding the learning;

61. • providing feedback to the learner;

62. • establishing conditions for retention and transfer of learning;

63. • and assessment of outcomes which form the post-test mentioned earlier.

/138

64. The touchstone of an effective strategy is an effective application of the communications process.

65. But whatever the communication mode, there must be a general appreciation of INTRAPERSONAL and INTERPERSONAL COMMUNICATIONS. INTERPERSONAL includes the rapport between the learner and materials and the learner and the teacher when the teacher acts as a mediator of learning information.

66. Members of the production team must identify with the learner and be aware of the need for both intra- and interpersonal communication.

67. The process of programmed instruction is a very useful development.

68. It includes many of the procedures already identified as necessary for learning system production:

69. • statement of objectives;

70. • information presented in progressive and logical sequence of optimal steps; /139

71. • involvement of student by continuous interaction with the program;

72. • reinforcement of learning by immediate confirmation of responses;

73. • self-pacing and individualization of learning;

74. • constant evaluation of the program's efficiency and the student's progress.

75. Mediation possibilities must be explored to best accommodate the desired learning outcome, the strategy chosen, students characteristics, and other constraints such as time and money. Mediation possibilities are numerous--audio and video tapes, games, models, films and filmstrips, teaching machines, computers--a vast range from simple to highly complex.

76. The intermeshing of media and learning strategy is a critical and costly process although a single medium may satisfy, a combination of media may serve more effectively.

77. Some helpful considerations in the selection of media include: the instructional functions to be performed;

78. the learning situation (Is it a real, a synthetic, or symbolic experience?); /140

79. stimulus and the response characteristics;

80. the time devoted to a particular learning event;

81. the type of utilization (Is it to be used by an individual or small group, or must it accommodate a large group learning activity?);

82. availability of time, money, production staff, and facilities.

83. The learning sequence is finalized, and if needed, a visual, aural, or tactile component is developed.

84. Budget is determined for production of the pilot package in "rough" format. It is produced, and the "pilot" system is tested on the students for whom it was designed.

85. The test results are analyzed and strategy components revised, optional sequences developed or eliminated and the revised material retested.

/141

86. The master sequence and optional sequences, along with diagnostic and post tests, are placed within a management framework and the system as an entire interlocking unit is constructed.

87. The full system is put to test on a larger test group, either in an actual school system or perhaps in an institute program if professional training is the objective.

88. This validation testing puts the learning system to test in the field with the target student population. Personal supervision of the system by the members of the production team should be shifted at this point, to actual instructional specialists in the field.

89. Diagnostic tests, already performed on the developmental "test" group are again used on the field group.

90. Empirical evidence is then fed back to the production unit for analysis and revision.

91. Again the system is put into the field. Results of such exposures, to a greater or lesser degree, will determine whether the learning system stands as a valid piece of curriculum, or whether it should be discontinued.

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92. The system is never a rigid, fixed, finished product; it is a flexible, responsive unit that must continue to meet the learners' needs.

LEVEL TWO: PROCEDURAL ACTIVITY

The packages in this level are designed to provide certain skills and discrimination abilities in specific areas of educational technology. Completion of every package in this level will not make you a skilled educational technologist, but it will go a long way toward providing /143
the basic critical skills necessary for further development.

A) Read through the descriptions before using any particular package.

B) At any point in the program you may refer to any or all of these packages.

C) Pick a package and complete the pre-test. Remember that these tests (assessments) provide you with the data necessary to decide whether or not to go through the learning sequence.

D) If the pre-assessment results indicate a need to go through the learning sequence (or if you want to go through it in any case) read the hardware requirements listed on the description page (or in the case of the commercially produced material, in the specific utilization instructions included with the material).

E) Set up hardware and go through the learning sequence. Proceed at your own pace. Stop and go back, or just stop at any point you wish in the sequence. There is no time limit.

F) After completing the learning sequence, complete the post-assessment. This test will indicate how successful the learning sequence was in communicating its content. By /144
comparing your post-assessment and pre-assessment responses, you will be able to evaluate the changes in your learning behavior which have resulted from the presentation.

G) You may now go on to another package and repeat steps C through F. Remember, at any point you may stop and utilize level three or return to level one.

There is no specific activity requirement for level two. You may utilize all, part, or none of the material on this level. The materials are available to assist in meeting your learning needs.

The following package titled Criterion Referenced vs. Norm Referenced Testing was prepared by

Writers: Anna Mae Patterson
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Audio: Douglas Boyd

Editing & Revision: Dr. Gabriel D. Ofiesh
Clarice Leslie
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Criterion Assessments: Peter Scott

Manuscript Coordinator: Dorothy B. Lutz

CRITERION REFERENCED
VS.
NORM REFERENCED
TESTING

This package is an audio tape/workbook designed to present the distinctions between criterion and norm referenced testing. In addition, justification for use of criterion testing is given. Examples of actual criterion test questions, both in terms of content and use, are used throughout the presentation.

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Criterion Reference vs Norm Reference Testing

The following script has been written for audio tape/slide presentation. For initial validation and preparation, however, it is being presented in audio tape format only.

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1. In a typical classroom we often hear a student say something like, "Boy, did I bomb that exam! I thought she was going to ask us what happens when you put acids and bases together; instead, she asked us to write the formulas for the reactions."

2. That teacher's comment might be: "Look at the curve on this test! I may have to throw it out and give another. My instructions were perfectly clear. It's obvious they hadn't studied the assignment."

3. These very real incidents reveal how serious a problem testing is in the educational process.

4. Questioning traditional testing philosophy begins, "What do we want our test to measure?" When we test, what are we trying to find out about the learner?

5. This basic testing question clearly hinges on what we want to teach the learner.

6. Ordinarily the teacher presents a unit of material in three days, five days, a week or two weeks to a group of learners.

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7. During that unit presentation, or at its completion, there is a testing period.

8. The teacher may hand out a sheet of paper on which is written a series of problems for the test. A student might be able to elect three of five questions, or some such arrangement. Basically, there is a body of knowledge on which all the learners are expected to demonstrate mastery.

9. They are not only expected to demonstrate that knowledge, but they are expected to do so on a given day, within a given period of time, and pretty much to the same level of proficiency. What does this really mean?

10. In general practice when a teacher tests, he is not testing the student against himself. The teacher has a pre-set optimum standard starting with "A" and working

10. Continued.

down. The student results generally follow a normal distribution curve. Certain characteristics result from this approach:

11. First, the teacher assumes he is testing a group: all the students in the class, not individual students.

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12. Second, the teacher is looking at the performance of the whole class, not of learner A or learner B.

13. Third, the teacher often attributes high failures on a test to lack of student preparation rather than the instruction and direction.

14. Fourth, the teacher may conclude the <u>test has no use</u>, except to show that there was no learning and that he must go back and teach the same material all over again, to all of the students.

15. These may be very typical reactions of teachers, who are caught in the trap of traditional testing.

16. This traditional use is called norm referenced testing. Norm reference describes the purpose of the test: to select and screen.

17. It is designed to separate and classify individuals in a group at some point in time.

18. Norm referenced testing places each student in a slot referenced to the average ability of the entire group (the norm).

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19. Individuals are not recognized as individuals; they are members of the group. Success or failure is in relation to the norm.

20. This view is the core of the trap. Our teacher will conclude the test was a failure because it did not produce a high enough "group" score. She may try again, with more tests, until she finds one which clearly shows that most of the group has learned the material.

21. In certain cases, the best student in the class is the "A" student.

22. He becomes a model against which the achievement of the other students is measured.

23. Norm referenced testing is used to measure what a student can achieve against some kind of goal outside himself.

24. This type of testing is standard testing in the classrooms of America, at almost every level from elementary through college.

25. However, there is another kind of testing that has more value for the individual learner known as CRITERION REFERENCED TESTING.

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26. Criterion referenced testing refers to those tests designed to measure whether the student has achieved the specific learning goals identified for him.

27. A clearly defined statement of behavioral goals is necessary before there can really be a test.

28. Criterion referenced tests are developed only after behavioral goals have been established.

29. Criterion referenced testing is substantially different from norm referenced testing.

30. The objective of a criterion referenced test is to measure to what degree the individual learner has attained a specified set of learning objectives.

31. Each student begins a learning sequence with a pre-test which determines his learning level at the start of the sequence. The difference between his entry skills and his final skills is a determination of the learning progress he has made.

32. The student is being tested in terms of his own progress. There is a pre-test which provides a measure or standard by which subsequent progress of the individual learner can be measured. /152

33. Psychologically for the learner there is less reason for him to cheat. The learning need is based on his individual progress in relation to mastery of the specific objectives rather than a class rank or position on a normal curve.

34. The pre-test, when subjected to an item analysis, is used to direct each learner to his own particular learning activity.

35. Another major advantage of criterion testing is accuracy due to the specificity of behavior that is measured.

36. Criterion referenced testing indicates individual student's learning difficulties.

37. As a result, criterion referenced testing measures individual performance against learning goals rather than the performance of other students.

38. The key word in criterion referenced testing is "individual."

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39. Using the teacher, student and test mentioned at the start of this presentation, let's look at the effect criterion referenced testing will have on all of them.

40. In both criterion referenced and norm referenced testing, specific test items may remain the same.

41. It is in the use of the test items that there is a difference. (This assumes that the items are accurate measurements of the specified objectives)

42. Suppose one student in the class made 50 percent in the examination.

43. In norm referenced testing, he would fail on a 100 percent grading curve.

44. Both he and the teacher would know he had failed. Traditionally the action would stop here unless it were a final exam which meant he would repeat the course.

45. Something quite different would happen in criterion referenced testing. Fifty percent on this exam would mean to the teacher that the student demonstrated acceptable performance on fifty percent of the test items. /154

46. Action would not stop at this point. Instead, the teacher would decide what additional work the student needed to improve his performance on the other 50 percent of the test items and what material the learner needed.

47. Criterion referenced testing makes an enormous difference to both the student and his teacher. They have a measure of his mastery of the learning necessary and not merely a "rank" in the class.

48. If we listen to the same students comments again we hear, "I know what happens when you put acids and bases together, but I'm not sure that I can write the formulas for the reactions."

49. If the teacher is working on a criterion basis his comment would probably be, "Let's see, this test shows these students seem confortable writing formulas for the reactions of acids and bases, but this student still has a problem. He needs some more help in this specific area."

50. Both student and teacher are able to evaluate progress and learning needs in terms of mastery of specified objectives. /155

51. Tests are an integral part of the educational process, but they no longer have to be traps for students designed by evil teachers. Instead, tests can be signs of individual growth and learning, and serve a positive rather than punitive purpose. It is the individual who learns, not the statistical average.

EDUCATIONAL TECHNOLOGY PROJECT

PRE-

criterion assessments

NORM REFERENCED

VS.

CRITERION REFERENCED

TESTING

For this report the desired responses have been included on the sheet opposite each question.

NATIONAL SCIENCE TEACHERS ASSOCIATION
1201 Sixteenth St., N.W., Washington, D.C. 20036

PRE-TEST

NORM REFERENCED VS. CRITERION REFERENCED TESTING

STIMULUS	RESPONSE
1. Test-day situation:	
A) A teacher presents a series of problems about a body of knowledge. All the learners are expected to show mastery of that knowledge within the same period of time to the same level of proficiency.	/157
What kind of testing is being described? A. Norm Referenced B. Criterion Referenced C. Neither D. Both	(A) Norm Referenced
B) When students or a student fails a test, the teacher concludes:	
"that the student has not studied enough or paid enough attention" A. Norm Referenced B. Criterion Referenced C. Neither D. Both	(A) Norm Referenced
or	
"that the test fails because it did not produce a high enough group score." A. Norm Referenced B. Criterion Referenced C. Neither D. Both	(A) Norm Referenced

STIMULUS	RESPONSE
Another test-day situation: C) A different teacher comes in and distributes the same test items used in situation A). However, this teacher uses the test to determine whether the learner has achieved his behavioral goals. A. Norm Referenced Testing B. Criterion Referenced Testing C. Neither D. Both	(B) Criterion Referenced Testing /158
2. Select the word or words that most accurately describes the function or purpose of the kind of testing that is being done in "test-day situation A)." A. Cross-sectional B. Separates the individual C. Measures the average or norm D. Diagnostic	(A) Cross-sectional (C) Measures the average or norm
3. Select the word or words that most accurately describe criterion testing. A. Diagnostic B. Cheatproof C. Tests the objective D. Rank in class	(A) Diagnostic (C) Tests the objective (B) Cheatproof
4. To implement criterion testing must a teacher design a separate test for each learner?	"No"

EDUCATIONAL TECHNOLOGY PROJECT

POST-

criterion assessments

NORM REFERENCED

VS.

CRITERION REFERENCED

TESTING

NATIONAL SCIENCE TEACHERS ASSOCIATION
1201 Sixteenth St., N.W., Washington, D.C. 20036

POST-TEST

NORM REFERENCED VS. CRITERION REFERENCED TESTING

Identify the following characteristics or uses as refering to either norm referenced (N), criterion referenced testing (C), or possibly both (B). Briefly justify all (B) answers.

_____ provides a cross sectional picture of student achievement.

_____ ranks students in relation to one another.

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_____ cheatproof.

_____ results of test are used for marking and rank only.

_____ results of test are used for remedial work in specific areas.

_____ students are measured in terms of a specific set of objectives.

_____ total test score is most important.

_____ each test item is important.

_____ test results determine future student success.

_____ test results determine learning weaknesses and strengths.

_____ high marks for all students mean test was too easy.

_____ item analysis provides teacher with indication of program weakness.

_____ learner need not repeat learning covering areas he has 'passed'.

_____ it is the use made of the test results in directing learning that is vital.

_____ if all students achieve high grades the teaching activity was successful.

_____ results provide the learner with a profile of his learning.

_____ if a learner fails he must go through everything a second time.

_____ low marks mean either the test was too hard or the students have not been doing their work.

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The following package titled Diagnostic Testing was prepared by

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Criterion Assessments: Peter Scott

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DIAGNOSTIC TESTING

This package contains an audio tape/workbook that presents the concepts of diagnostic testing as used in educational technology. It is shown to be a basic unit of any learning system development. Specific examples of the structure and use of each form of test within the diagnostic category are given.

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Diagnostic Testing

The following script has been written for audio tape/slide presentation. For initial validation and preparation, however, it is being presented in audio tape format only.

1. Medical doctors in treating patients customarily follow a process of diagnosis, /164

2. prescription, and treatment.

3. There is a growing realization among many educators that the educational establishment should follow somewhat the same procedure. This is especially true if individualized instruction is ever to become a reality.

4. In medicine a diagnosis is necessary before the patient is treated; similarly in education diagnostic tests of the learner are necessary before learning strategies can be perscribed or even developed.

5. It is necessary to know the learner's capabilities, and his reactions to various types of learning presentations. Essentially who the individual learner is, where he is, and how he learns.

6. What must be known about the learner is determined through DIAGNOSTIC TESTING.

7. There are two kinds of diagnostic tests: MASTERY OR CRITERION TESTS; ENTRY LEVEL TESTS.

8. The mastery or criterion test measures exactly what the student is able to do, what he knows, or how he behaves upon completion of the learning experience. /165

9. For example, let us assume the following behavioral goal for Bill: Given Boyle's law the student will be able to explain in mathematical terms the change in one cubic foot of O_2 when heated ten degrees.

10. In this case the criterion test is the operational definition of this behavioral goal.

11. The criterion test provides an explicit and precise description of what the learner can do when he reaches mastery:

12. There is direct observation of the kinds of problems he can solve;

13. the questions that he can be expected to answer;

14. the kinds of answers he can be expected to give.

15. Depending upon the criterion test, it is possible to determine

16. affective behavior usually through simulation activities, /166

17. cognitive growth on any level from simple response to unique problem solving,

18. and psychomotor skills through observation.

19. It is only by analyzing the criterion test results that we obtain a clear cut and precise grasp of what kinds of performance and behavior the learner is capable of.

20. Criterion tests should be the only acceptable measure which indicates to us whether the learner has achieved the level of proficiency which was stated in our objectives.

21. There are three forms of the criterion test: the <u>pre-test</u>, the <u>post-test</u>, and the <u>retention test</u>.

22. All three tests determine the same information about the learner. That is, how many of the specified objectives he can meet.

23. Pre-test information enables the teacher to avoid forcing the learner to repeat areas in which he is already competent and allows him to concentrate on the areas with which he is not familiar. /167

24. For example, if the pre-test results indicate that the student meets the minimum number of objectives (90 percent is the usual minimum), then the learner does not go through the learning system.

25. When the learner's prerequisite knowledge or skills are measured by a pre-test, there is a starting point from which to determine, after the student has gone through the learning activity, what progress he has made;

26. in other words, what gain in performance or change in behavior has been achieved.

27. Post-test information identifies areas where the learner does not meet specified outcomes. He can then be given other material to bring mastery of the objectives and is not forced into new areas with only half knowledge.

28. If the learner passes the post-test at or above the minimum passing score (usually 90 percent) then he has mastered the learning activity and is ready for another learning objective.

29. If the learner scores below 90 percent in the post-test, he is given remedial learning through learning strategies designed to meet his particular deficiency. This is repeated until he can achieve a predetermined mastery level on the post-test. /168

30. Retention test information shows whether the learner has retained the learning or needs refresher material. Usually, if there is a sequence of learning steps involved, retention tests as such are not needed. For example, if a child can accurately work long division problems, there is no need for a retention test on his ability to multiply and substract. He has demonstrated these skills by using them in long division.

31. In addition to the CRITERION TEST in its various forms, there are the important ENTRY LEVEL TESTS.

32. There are two kinds of entry level tests: The PRE-REQUISITES and the LEARNER CHARACTERISTICS tests.

33. The prerequisites test reveals whether the learner has the knowledge or skills necessary to successfully enter the learning system.

34. For example, John has little or no laboratory experience in his previous schooling.

35. He cannot identify certain laboratory apparatus, nor set up the equipment necessary for the learning system's activities. /169

36. Before John begins the learning sequence, he will need a preliminary learning strategy to acquaint him with the laboratory equipment.

37. The entry level prerequisites test enabled a diagnosis of and prescription for John's learning needs. The prerequisite test might also have determined whether John was familiar with certain terms which were essential to the understanding of the theory to be presented in the learning system.

38. In summary, the prerequisite test gives a basis for individual prescription, a tool to prevent a learner from entering a learning system in which he cannot function.

39. The other type of entry level test identifies as much as possible about the individual's learning characteristics.

40. This kind of knowledge enables the teacher to further manage the individualization of learning strategies.

41. The learner characteristics test should cover every possible facet of the student's learning history and interests. /170

42. At present, since there are no commercially available tests of this type, the teacher will have to rely on his own sensitivity to the learners that face him.

43. Often, no one knows the learner better than the learner himself.

44. It is the teacher's responsibility to draw from the student as much as possible about his past learning experiences (in and out of school), a picture of his study habits and the ways in which he enjoys learning most.

45. For example, does he prefer to learn by experimenting with materials on his own, or does he prefer working as a team with another learner?

46. Does he prefer listening to an audio tape or reading an assignment? What hobbies does he pursue at home? Does he aspire to a career to which the teacher can relate his everyday learning activities?

47. The answers to such questions as these will provide a basis for more accurate prescription of strategies and materials for the individual learner. /171

48. Properly used, all of the diagnostic instruments--the prerequisites and learner characteristics tests, the pre, post, and retention tests--give the teacher a full picture of the learner as an individual.

49. Based on this data, the learner can enter the learning system at the appropriate level, confident of success, and utilize materials that will work best with him.

EDUCATIONAL TECHNOLOGY PROJECT

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PRE-TEST

POST-TEST

RETENTION TEST

criterion assessments

DIAGNOSTIC TESTING

The underlined areas represent the blanks to be filled in. For this report we have included the desired responses along with the test questions.

NATIONAL SCIENCE TEACHERS ASSOCIATION
1201 Sixteenth St., N.W., Washington, D.C. 20036

DIAGNOSTIC TESTING

Fill in the missing word or words: single line indicates single word answers, double lines indicate multiple word answers.

1. We gather data on learners entering a learning program through DIAGNOSTIC tests. /173

2. These tests can be divided into two kinds, the ENTRY test, and the CRITERION tests.

3. The PRE-TEST test determines what a learner already knows about the subject to be learned.

4. The Pre-test, form B of the CRITERION test, measures WHAT A LEARNER ALREADY KNOWS ABOUT THE SUBJECT TO BE LEARNED OR WHAT COMPETENCIES HE ALREADY POSSESSES OF THOSE THAT ARE REQUIRED.*

5. The Post-test, form A of the CRITERION test, measures WHAT A PERSON HAS LEARNED AS A RESULT OF GOING THROUGH THE PRESCRIBED SET OF LEARNING EXPERIENCES.*

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*Answers do not have to be in exactly the same words, but the identical meaning must be conveyed.

6. There is a special test, form C of the Criterion test which measures WHAT KNOWLEDGES, SKILLS, AND COMPETENCIES THE PERSON RETAINS AFTER A PREDETERMINED PERIOD OF TIME AS A RESULT OF GOING THROUGH THE PRESCRIBED LEARNING EXPERIENCES.* In other words, this test is a RETENTION test.

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7. The two kinds of Entry Level tests are:

   A. The PREREQUISITES test which measures THE EXTENT TO WHICH THE LEARNER ALREADY POSSESSES THOSE SKILLS NECESSARY FOR HIM TO BE ABLE TO MANAGE THE LEARNING EXPERIENCES.

   B. The LEARNING-CHARACTERISTICS test measures THOSE CHARACTERISTICS OF THE LEARNER WHICH ARE RELEVANT TO THE KIND OF STRATEGIES WHICH ARE PRESCRIBED FOR THE LEARNER.

James Popham and Eva L. Baker

slide/tape series

Seven validated audiovisual programs, accompanied by response sheets, pre-tests and post-tests. /175

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1) writing behavioral objectives,
2) writing test items to test the objectives,
3) designing instruction which will keep his students interacting with the subject matter, and
4) testing the instruction to see if it does what it was intended to do.

Distributed by General Programmed Teaching, 424 University Avenue (P.O. Box 402), Palo Alto, California 94302.

"Quik Topic" Filmstrips

A series of filmstrips with accompanying audio tapes, produced and distributed by Educational Media Incorporated, 106 West Fourth, Ellensburg, Washington 98926. /177

Selected titles include:

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Dial Access Information Retrieval Systems

Computer-Assisted Instruction

Really Understanding Concepts:

or in frumious pursuit of the jabberwock

A slide/tape presentation with workbook, produced and distributed by Susan M. Markle and Philip W. Tiemann, Tiemann Associates, University of Illinois at Chicago Circle, Chicago, Illinois.

Selection and Use of Programmed Materials

A color filmstrip with accompanying handbook, produced and distributed by the Department of Audio-visual Instruction, 1201 Sixteenth Street, N.W., Washington, D.C. 20036.

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LEVEL THREE: SUPPORT MATERIAL

Level three consists of a selected listing of printed material and films which extend and refine the concepts presented in levels one and two. You may utilize these materials at any point in Set II. Certain items were included for your future reference; e.g., the section "Sources of Information for Media Selection." The structure of this bibliography is self-explanatory. /180

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An annual directory, produced by the trade association of audiovisual hardware manufacturers, includes pictures and specifications of the equipment.

Audiovisual Marketplace: A Multimedia Guide, second edition. New York City: R. R. Bowker Company, 1970. ($12.25)

The most comprehensive directory of hardware and software manufacturers/producers/distributors. Includes listings of media organizations, periodicals, film libraries, educational radio and television stations.

Educators Guide to Free Science Materials. Randolph, Wisconsin: Educators Progress Service, 1968. ($8.25)

Lists free films, filmstrips, tapes, transcriptions, and other printed material.

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Educational Products Report. Published monthly, October-June. Educational Products Information Exchange, 386 Park Avenue South, New York, N.Y. 10016.

Each issue covers a specific product; e.g., recent issues have included black studies materials, science kits, programmed instruction materials, 8mm projectors and films. The Report contains objective data on equipment and materials which will save weeks of staff time in searching through promotional literature to gather information for purchasing decisions.

Carl Hendershot. Programmed Learning: A Bibliography of Programs and Presentation Devices, fourth edition. Bay City, Michigan: Carl Hendershot, 4114 Ridgewood Drive. ($27.50, including supplements through June 1970)

Index to 16mm Educational Films, second edition. New York City: R. R.Bowker Company, 1969. ($38.50)

Contains 35,000 entries for commercially available 16mm films. More than 10,000 entries in the natural and physical sciences.

Index to 8mm Educational Film Loops, first edition. New York City: R. R. Bowker Company, 1969. ($16.00)

Approximately 10,000 entries for commercially available 8mm film loops.

Index to 35mm Educational Filmstrips, second edition. New York City: R. R. Bowker Company, 1969. ($34.00)

Some 25,000 entries.

Index to Educational Transparencies, first edition. New York City: R. R. Bowker Company, 1969. ($20.00)

Some 15,000 entries.

SELECTED 16 MILLIMETER FILMS ON EDUCATIONAL TECHNOLOGY AND MEDIA

"Audio-Tutorial System: An Independent Study Approach," 25 minutes, color, 1968. Produced and distributed by Purdue University Audio Visual Center, Lafayette, Indiana 47907.

Film illustrates the teaching methods of S.N. Postlethewait, developed for an introductory course in botany at Purdue. /193

"The Communication Revolution," 21 minutes, black and white, 1963. Produced and distributed by the Ohio State University Motion Picture Department, 1885 Neil Avenue, Columbus, Ohio 43210.

Discusses the impact of the information explosion and the mass media of communication on western civilization. Questions a new distribution of power through a redistribution of information and the inevitable need for discrimination in teaching media.

"Learning About Learning: Learning Research," 28 minutes, black and white, 1963. Produced by National Educational Television, distributed by Indiana University Audio-Visual Center, Bloomington, Indiana 47401.

Discusses studies conducted with human beings and animals which have already led to changes in instructional methodology in schools and colleges.

"Let Them Learn," 27 minutes, color, 1967. Produced and distributed by Encyclopedia Britannica Educational Corporation, 425 North Michigan Avenue, Chicago, Illinois 60611.

Examines the characteristics of educational films which make film significant teaching material. Illustrates film use in planned and spontaneous teaching situations.

"More Different Than Alike," 30 minutes, color, 1967. Produced and distributed by the National Education Association, 1201 Sixteenth Street, N.W., Washington, D.C. 20036.

Depicts unique and creative techniques which provide for individual learning differences.

"My Name is Children," 60 minutes, black and white, 1967. Produced by National Educational Television, distributed by Film Associates, 11559 Santa Monica Boulevard, Los Angeles, California 90025.

Portrays an inquiry approach to motivate students at the Nova Elementary School, Fort Lauderdale, Florida. Shows teachers meeting to discuss coordination of plans and individual students problems. /194

"Oakleaf Project," 28 minutes, black and white, 1968. Produced by the University of Pittsburgh, distributed by William W. Matthews & Company, Inc., 130 Seventh Street, Pittsburgh, Pennsylvania 15222.

Follows one child in the individual-centered instruction project at the Oakleaf Elementary School.

"Paths to Learning," 19 minutes, color, 1964. Produced and distributed by Colorado State Department of Education, State Office Building, Denver, Colorado 80203.

Presentation of Colorado Western State's small schools project. Illustrates, through actual classroom sequences, use of instructional media to individualize instruction and free the teacher for individual instruction.

"Revolution in the 3 R's," 60 minutes, black and white. Produced by ABC-TV, distributed by Minnesota Mining and Manufacturing Company, Medical Film Library, 2501 Hudson Road, St. Paul, Minnesota 55119.

Three new methodologies in American education are described: the Summerhill technique of children's self-government, the Montessori method, and the "New Math" program.

"The Second Classroom," 25 minutes, black and white, 1960. Produced by the Department of Audiovisual Instruction, distributed by the National Education Association, 1201 Sixteenth Street, N.W., Washington, D.C. 20036.

Various systems of educational television are described. Specific characteristics of television are cited: intimacy, immediacy, accessibility of otherwise unavailable teaching resources (both facilities and personnel), suitability as teacher training tool.

"The Teacher and Technology," 49 minutes, color or black and white, 1967. Produced by the U.S. Office of Education, distributed by the Ohio State University Motion Picture Division, 1885 Neil Avenue, Columbus, Ohio 43210. /195

From the "Communication Theory and New Educational Media" series, presents a series of pictorially documented programs which illustrate some of the ways technology is being used to meet the dual problems of masses of students and the need for individualized instruction.

"Teaching the One and the Many," 28 minutes, color, 1968. Produced and distributed by the National Education Association, 1201 Sixteenth Street, N.W., Washington, D.C. 20036.

An individualized learning center in a rural junior-senior high school is the setting for a review of "hardware" and "software" currently available in schools. Emphasis is placed on the development of "software": films, film-strips, programmed materials, video tapes, and teaching kits.

"Television Techniques for Teaching," 23 minutes, color, 1968. Produced and distributed by the San Diego Area Instructional Television Authority, 5164 College Avenue, San Diego, California 92115.

Demonstrates practical approaches for television utilization in the classroom.

"This is Marshal McLuhan: The Medium is the Message," 29 minutes, color, 1968. Produced by NBC-TV, distributed by McGraw-Hill Textfilms, 330 West 42nd Street, New York 10018.

Marshal McLuhan narrates an exploration of the changes brought about by electric technology and the effects of mass media on modern man. A variety of photographs and editing techniques are employed in the film.

A P P E N D I X

CRITERION TEST FOR SET II

EDUCATIONAL TECHNOLOGY PROJECT

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criterion assessments

The following criterion test is a prototype of a pre-post assessment that will provide participants with an evaluation of their understanding of educational technology concepts and how these concepts fit into a working definition of educational technology.

If you intend using all of Set II, this test will give you a broad basis for evaluation of learning change. It will also serve as a glossary of the more common educational technology terms.

NATIONAL SCIENCE TEACHERS ASSOCIATION
1201 Sixteenth St., N.W., Washington, D.C. 20036

PRE - POST

1. Match the educational technology terms with the appropriate definitions. (These are not intended to be all inclusive but are the more common terms used in the materials of this set.)

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LIST OF EDUCATIONAL TECHNOLOGY TERMS

1) Behavioral Objectives _____

2) Contingency Management _____

3) Criterion Test _____

4) Diagnostic Test _____

5) Educational System _____

6) Enabling Objectives _____

7) Entry Level Test _____

8) Feedback _____

9) Instructional System _____

10) Learning Strategy _____

11) Learning Style _____

12) Learning System _____

13) Lecture _____

14) Mastery _____

15) Pre-Test _____

16) Programmed Instruction _____

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17) Post-Test _____

18) Retention Test _____

19) Student Assessment _____

20) Terminal Objectives _____

21) Validated Instructional Materials _____ /200

22) Validation _____

DEFINITIONS OF EDUCATIONAL TECHNOLOGY TERMS

A. States a goal of instruction in terms of what behavior the student will exhibit to prove that he has attained it.

B. A statement of what the student will be able to do at the end of the instruction. /201

C. Objectives which must be mastered before the terminal objectives can be mastered.

D. What you need to know about each learner to make his instruction individualized.

E. The means by which you find out what you need to know about each learner to make his instruction individualized.

F. A determination of what the learner brings with him to the learning situation, including already acquired skills and knowledge, learning characteristics, attitudes and values, and motivational factors. Also, an evaluation of whether or not he has the initial learning necessary to successfully go through a particular learning situation.

G. Measure the student's mastery of a learning objective.

H. A form of the criterion test given prior to the instructional sequence to determine what degree of mastery a student may already have.

I. A form of the criterion test given immediately after the instructional sequence to determine to what degree the objective has been mastered.

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J. A form of the criterion test given after a period of time has elapsed to determine how much of the instruction has been retained.

K. The student exhibits behavior which indicates that an objective has been met.

L. The sequence of activity provided to bring a learner from entry level to mastery of an objective including the materials chosen for instruction, their implementation, and their transmission to the learner.

M. A method of instruction which provides for active response by the student, immediate knowledge of results, and individual pacing.

N. One of <u>several</u> learning options available to a student which can be an effective communication vehicle if used correctly - e.g. to stimulate further thought.

O. How a particular student learns most effectively - by listening, seeing, speaking, writing, reading, or a combination of these.

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P. The process of determining whether the use of given materials result in achievement of objectives by the students they are to be used with.

Q. An overt behavior - verbal or nonverbal, written or oral - which indicates the effectiveness of instruction. (Also used as a process by which information concerning the learner effects the content of the system.)

R. The system which ideally forms the base of a learning pyramid, supporting both the instructional system and the learning system. It includes such elements as the school board, the taxpayer, physical facilities, administrators, and state departments of education.

S. The system in the learning pyramid which most directly supports the learning system and includes such elements

S. Continued

as the teacher, instructional materials, media, tests, and other tools which create an environment to support the learning process.

T. The most important system in the learning pyramid, appearing ideally at the apex of the pyramid. It consists of the learner involved in a structured learning process. /204

U. Management of learning which provides motivation through rewarding or reinforcing positive behavior.

V. Materials which have been tested and found to produce learning to a pre-set standard.

DESIRED RESPONSES TO PRE-POST ASSESSMENT

(1) Behavioral Objective: A. States a goal of instruction in terms of what behavior the student will exhibit to prove that he has attained it.

(2) Contingency Management: U. Management of learning which provides motivation through rewarding or reinforcing positive behavior. /205

(3) Criterion Test: G. Measures the student's mastery of a learning objective.

(4) Diagnostic Test: E. The means by which you find out about each learner to make his instruction individualized.

(5) Educational System: R. The system which ideally forms the base of a learning pyramid, supporting both the instructional system and the learning system. It includes such elements as the school board, the taxpayer, physical facilities, administrators, and state departments of education.

(6) Enabling Objectives:	C. Objectives which must be mastered before the terminal objective can be mastered.
(7) Entry Level Test:	F. A determination of what the learner brings with him to the learning situation, including already acquired skills and /206 knowledge, learning characteristics, attitudes and values, and motivational factors. Also, an evaluation of whether or not he has the initial learning necessary to successfully go through a particular learning situation.
(8) Feedback:	Q. An overt behavior - verbal or nonverbal, written or oral - which indicates the effectiveness of instruction. (Also used as a process by which information concerning the learner effects the content of the system.

(9) Instructional System: S. The system in the learning pyramid which most directly supports the learning system and includes such elements as the teacher, instructional materials, media, tests, and other tools which create an environment to support the learning process.

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(10) Learning Strategy: L. The sequence of activity provided to bring a learner from entry level to mastery of an objective, including the materials chosen for instruction, their implementation, and their transmission to the learner.

(11) Learning Style: O. How a particular student learns most effectively - e.g. by listening, seeing, speaking, writing, reading, or a combination of these.

(12) Learning System:

T. The most important system in the learning pyramid, appearing ideally at the apex of the pyramid. It consists of the learner involved in a structured learning process.

(13) Lecture:

N. One of <u>several</u> learning options available to a student which /208 can be an effective communication vehicle if used correctly - e.g. to stimulate further thought.

(14) Mastery:

K. The student exhibits behavior which indicates that an objective has been met.

(15) Pre-Test

G. Measures the student's mastery of a learning objective.

(16) Programmed Instruction:

M. A method of instruction which provides for active response by the student, immediate knowledge of results, and individual pacing.

(17) Post-Test

I. A form of the criterion test given immediately after the instructional sequence to determine to what degree the objective has been mastered.

(18) Retention Test:

J. A form of the criterion test given after a period of time has elapsed to determine how much of the instruction has been retained. /209

(19) Student Assessment:

D. What do you need to know about each learner to make his instruction individualized?

(20) Terminal Objective:

B. A statement of what the student will be able to do at the end of the instruction.

(21) Validated Instructional Materials:

V. Materials which have been tested and found to produce learning to a pre-set standard.

(22) Validation:

P. The process of determining whether the use of given materials results in achievement of objectives by the students they are to be used with.